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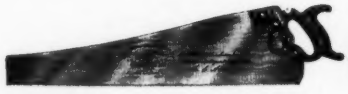
The INDUSTRIAL-ARTS MAGAZINE

APRIL 1927

The Bruce Publishing Company
Milwaukee Wisconsin

ATKINS SILVER STEEL SAWS

A Perfect Saw for Every Purpose



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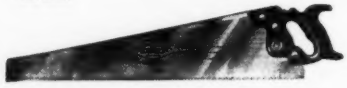

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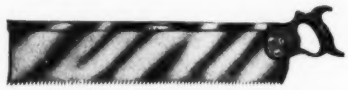

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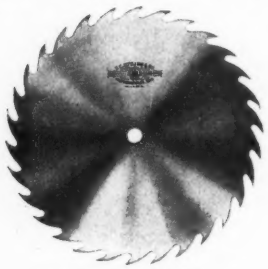

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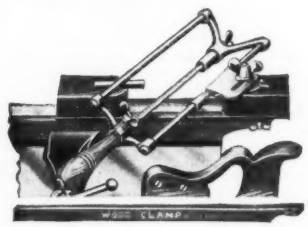

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JOB SHEETS IN VOCATIONAL TEACHING

Robert H. Rodgers, Milwaukee Vocational School

"JOB SHEETS IN VOCATIONAL EDUCATION" represents a very distinct endeavor in the educational field that seeks to reach and better serve the individual. The principles involved in this development are applicable to all types of subjects, but in this paper the discussion will be narrowed essentially to educational work in the fields of industry, commerce, and homemaking.

An analysis of the subject indicates that there are at least five subdivisions worthy of some consideration. Therefore, the following phases will be presented, (1) the development of the job-sheet idea; (2) the instructional problem in vocational classrooms; (3) some basic factors in the educational problem; (4) job sheets or units of instruction as a means of meeting the problem; (5) some results from the use of instructional material in this form.

The Development of the Job-Sheet Idea

The job sheet is attracting an unusual amount of attention. To some it may seem that it has literally sprung into existence over night when, as a matter of fact, it represents but a stage in the gradual development of improved methods of organization and teaching. As its development is reviewed, a great deal of credit must be given to the contributions made by the well-organized science laboratory manuals used in secondary and higher institutions. The correspondence school and its pamphlets and system of examination gave an invaluable experience, as did the scientific studies in industry and the factory production sheets. The use of blue prints in the manual-training shops and in the schools of engineering was a distinct step in the direction of the job-sheet idea. A great impetus came at the period of the World War when Allen and Selvidge were confronted with the almost overwhelming problem of training the personnel of the shipyards and the special branches of the service in the army. Job sheets made up in the form of instruction manuals were one of the many successful means employed. The inauguration of the part-time-school program in the State of New York resulted in the drawing together of the best elements of each of these movements and the development of a plan of organization for teaching by the use of individual units, called by some job sheets, by others units of instruction. The staff of the Division of Vocational and Extension Education of the New York state educational department was confronted with the problem of making the instruction most effective for the many thousands of young men and women returning to school for a short period of time each week. The result of their efforts was but another step in the refining process that is taking place in the field of organization and methods. It is apparent, therefore, that job sheets or units of instruction, or whatever term may be used, are not new, but rather they represent the present status of a progressive educational movement.

The Instructional Problem in Vocational Classrooms

The greatest concern at present is not how the idea came about but rather how job sheets can be prepared and how they should be used. An answer to these aspects will necessitate a brief analysis of the instructional problems that confront all teachers of the practical-arts or vocational subjects.

First, it must be recognized that every student in a class represents an individuality that differs in interests, desires, and powers of accomplishment. These manifestations express themselves and result in students in a well-conducted class being spread over a considerable range of varying activities. Second, the very nature of the equipment and materials in many of the practical or vocational subjects necessitates group or individual instruction. Third, the wide range of activities in progress at any one time in the class means that the teacher must spread his efforts in order to serve individual students. Fourth, the spreading of the teacher's efforts frequently results in loss of time and accomplishment by the student, due to the inability of the teacher to render assistance at the opportune time.

The presentation of the larger elements of the instructional problem confronting the teacher of practical arts or vocational education emphasizes the need for an agency or a method that will enable teachers to function to the fullest possible capacity and thereby serve the learners wholly according to their individual needs. The job sheet or the unit of instruction has been one of the answers of the teacher to the challenge of more effective educational service.

Some Basic Educational Factors Involved in the Problem

In attacking the problem it has been found that in the enthusiasm accompanying what appears to be the newly-found salvation, certain abuses have found a place in the current practice. Certain very basic educational factors have been disregarded or have been misinterpreted to such an extent that it seems most pertinent to review for a moment the following principles of pedagogy and curriculum construction.

1. *Significance of individual differences.* Recognition of individual differences should mean individual instruction which in turn involves the use of the same principles of teaching that are utilized for class instruction. There is a tendency for the teacher to slight or even ignore what is known as good practice when aiding a single student. Effective individual instruction always requires that the teacher shall diagnose each student and prescribe the specific educational treatment that is needed. Intensity and the volume of the treatment and the methods of treatment cannot be overlooked in the scientific and human procedure that each case will require.

2. *Interest as the basis of educational progress.* Individual educational progress is conditioned by the interests of the individual. A pertinent and proper question is, Do we get the interest of the individual student when problems are discussed that do not touch his life, that are too far advanced, or that are too elementary? Students are most interested when they are at work upon their own personal problems, and this is especially true when these problems are presented to them in the form of challenges that set them upon their mettle.

Teachers will find that it is very frequently necessary to skillfully reshape and direct the interests of individuals so that they may be more nearly in accord with the best interests of the concerned person. Prevailing interests, even though questionable, may be utilized to initiate the more desirable interests. Teachers should always bear in mind that interest is the compelling personal force that sets the individual at work and that self-activity is the only means of growth and development.

3. *Self-activity and the process of acquisition.* It is extremely trite to cite that every activity accorded a place in a school program should be there because it has a specific value for individual students. In other words, the school or the classroom is the agency established to provide a continuous series of selected experiences that will develop the powers and the abilities of the learner. Methods of teaching and the curriculum must present problems to the learners in such a manner and of such a nature as to develop a desire to attack and an opportunity to accomplish. Problems should be selected so that each succeeding one will offer the degree of resistance necessary to insure a continuous growth at a rate commensurate with individual ability. The learner meeting the appropriate resistences and overcoming them from day to day is developing power. There is but one procedure for the learner: namely, attack and solve the selected educational problems as largely as possible by your own efforts and thereby develop the power to accomplish. Any method that deprives the student of this opportunity is faulty in its conception and detrimental in its execution.

4. *The curriculum.* The curriculum should be a thoroughly organized body of selected information and experiences and available in all of its parts for the student to use at the appropriate time. It should be in most respects representative of life conditions and afford every opportunity for personal interpretation and application. The curriculum and its component parts, the courses of study, should never be hastily assembled material of a miscellaneous nature, but scientifically selected and tried information and experiences pertinent to the needs and problems of the specific community and classroom. Too hasty adoption of printed material as it is now pouring from the publishers may mean well-organized material but not wholly adaptable to particular needs.

5. *The teacher.* Any plan of effective individual instruction in the classroom will add greatly to the responsibility and to the work of the teacher. There has been apprehension on the part of some that with the complete organization of instruction material a teacher would not be necessary, or, if he is, that his usefulness is one of merely accounting for the physical details of the classroom. It will always be the function of the teacher to give the classroom the human touch, and to inspire, to guide, to encourage, and to aid the learner to develop his powers for wholesome and desirable ends.

Job Sheets or Units of Instruction as a Method

The problems of improving the teaching and securing more effective results have been presented and now the details of the method to be employed are pertinent. The job sheet or the unit of instruction has been advanced as the method to be employed and, therefore, will be analyzed somewhat closely. In defining the job sheet or unit of instruction it may be said that *it is one unit of a body of organized instructional material prepared for the use of the learner, and consists of educational assignments so organized as to provide for the greatest amount of individual progress.* Checking some of the sheets that are in use today by this standard would result in many going into immediate discard or being substantially revised.

1. *Elements entering into the make-up of individual units.* A well-prepared unit of instruction, in order to be wholly educational, must be prepared according to rather definite standards. These standards may be grouped as follows:

a. Objectives must be stated so clearly and directly that learners will readily understand them.

b. Students must be introduced to the new assignments in a manner conforming to accepted pedagogical practice. The principle of apperception cannot be slighted. This will require a short introductory paragraph very carefully planned for each unit sheet or job sheet.

c. All assignments should be so clearly given as to enable every student to undertake his work without loss of time. Arrangement and illustrations cannot be overlooked in the preparation of units.

d. All assignments should involve the solution of an educational problem calling for the best efforts of the learner. Merely specific directions for carrying out a certain number of manipulative operations is in violation of the principle of self-activity and should be used only in a very limited way. First sheets may give specific directions but succeeding sheets should gradually place more and more responsibility upon the learner.

e. All assignments should be progressive, thereby tending to insure the learner's progress.

f. All of the assignments on a given unit should be as closely coordinated as is possible and should include both the practical and the related technical aspects. Technical material thus given becomes more vital to the learner.

g. Provision should be made on each unit for the learner to record his procedure or knowledge of essential information as he develops the assignments. The units are to become his permanent property.

h. The assignments on each unit should preferably cover only one day's work. This should assist the student to complete a very definite field of work each day and, with its completion, to carry away a sense of accomplishment.

2. *Using the job or the unit sheets.* The preparation of the job sheets or units is a task of no mean proportions, but it is also a problem to use the organized material in the most effective manner. Again, it is possible to point out certain aspects that merit rather close attention.

Organization of the class. Class instruction should always be used when it is certain that all of the members of the class will profit to the fullest possible extent. It is decidedly an economy of time and effort to offer instruction to the largest possible group. If it is found that the same unit cannot be used with all of the members of the class, then the teacher's procedure is to group the students according to stages of progress and ability and use separate sheets for each group. It will also probably be discovered that certain individuals cannot be placed in a group which means the making of an assignment of a specific unit according to their needs. A guiding principle for every teacher should be, organize the entire class program so that you may be available to render the greatest amount of help, assistance, and guidance to the individual members of the class.

Class or group discussions. There is a place during every class period for a class or group discussion of common elements of the instructional material. In the shops, homemaking laboratories, and commercial rooms this discussion may be based on a study of materials, supplies, equipment, common practices or procedure, and topics of a similar character. It is recommended that class or group discussions be short; preferably not longer than fifteen or twenty minutes, and so planned as to present one, two, or three very essential things with an opportunity for the students to participate in their development.

Assigning units to students. The assignment of educational work to students is one of the essential elements of good teaching. The practical aspects of assigning the job or unit sheets may be better understood through an illustration. The first fifteen or twenty minutes of the class period may be

devoted to a demonstration and discussion of fundamental equipment to be used by all the students in some one of the problems that they are to work upon. This is followed by the passing of selected unit instruction sheets to individual members of the class who then proceed to take up their work. It is reasonable to expect that if the class is not a beginning one that it is divided into two, three, or four groups according to progress. In some instances it may be necessary for the teacher to take a small group and offer assistance; at other times all will get under way with little help. If the assignments are clear, concise, and well defined, even though the teacher may give some time to one particular group, the other groups are able to proceed. Under the unit-lesson organization there is little excuse for the student coming to the teacher with the statement, "I have finished this piece of work, what shall I do next?" What to undertake next should be clearly indicated on each sheet and, when the student understands the requirements that are specified thereon, much of the delay and loss of time so prevalent in classwork will be eliminated.

Responsibility of the teacher. Job sheets or units in any form are specifically for the purpose of supplementing the efforts of the teacher and thus enabling him to render greater assistance to individual members of the class. As has been previously indicated, they add to the teacher's responsibility for close follow-up, individual help, and careful checking of results.

Physical provisions. In order that the entire plan shall move smoothly, there must be provided a certain amount of storage space to keep units in a systematic order; each unit must be available when needed, and students must have some means of keeping them after having worked upon them. Every teacher must also keep a progress chart that will show the location of a student and the quality of his work at any time. This enables the teacher to always make the assignments to students in terms of needs.

The results attained thus far by the use of this method more than warrant the continuance of intensive work concentrated upon the technic of organization and utilization in the classroom.

Some Results from the Use of Units of Instruction

The discussion thus far has attempted to present (1) the causes that have brought about the development of the job- or unit-sheet idea, and (2) the practical factors that are involved in preparing and using them. It now remains, in conclusion, to indicate some of the results that are already apparent where this method is being used.

First, the instructional material for vocational classes is now better organized in all of its details than ever before. A teacher possessing a course of study a few years ago felt that it was wholly sufficient, whereas today it is felt that the course of study must be prepared in the form of units for the use of individual students.

Second, teachers are now recognizing that students are different and are offering instruction in terms of their individual differences.

Third, recognition of the individual as the unit of instruction provides the opportunity for the teacher to assign the type and kind of problem that will interest and thereby insure the self-activity essential to educational progress.

Fourth, the job sheet or the unit of instruction, educationally conceived, has been a factor in enriching the course of study in the vocational subjects. The barrenness of some of the older forms of work was very apparent when a thorough organization was undertaken.

SHEET METAL AS A TRADE-SCHOOL SUBJECT

J. A. Brandt, Mooseheart, Ill.

THE purpose of this article is not to enumerate projects or work to be included in a sheet-metal course, but to present in the form of an analysis of the trade, certain conclusions and statements and to show sources from which projects were drawn.

Primarily, it is hoped that this analysis will be of some aid in the organization of new sheet-metal shops in the schools, and in the systematic selection of the projects that have definite trade value as well as educational value.

In organizing the work to be covered in the Mooseheart sheet-metal courses, it was found necessary to make an extensive survey of the trade and to classify the work of the trade as shown in the accompanying chart. This chart was compiled to some extent from lists and data furnished by teachers of sheet-metal classes and by employers located in all parts of the United States.

While it cannot be assumed that the work listed is complete, it does present what might be called a cross section of the work done by the mechanic, known as a sheet-metal worker, in sufficient detail so that certain conclusions may be drawn and used as a basis for selecting problems and work to be included in any sheet-metal course. No restrictions have been placed on the work done in the Mooseheart sheet-metal shop; consequently it has been possible to study and try out a number of methods of teaching the trade and to reproduce in the school shop conditions closely resembling those in commercial-shop practice. It has been possible to place students on various types of buildings under construction and to try out production work in the shop.

It will not be practical to use these methods in the average school shops, but the results of the experiments made in the Mooseheart shop will be of value in organizing the work to be done in any school shop, and for this reason they form the basis of this article. It cannot be assumed that all conclusions or suggestions will apply in every school as local conditions and the type of students will govern their adaptability to a large extent. The work classified as belonging to the trade covers such an extensive field, that the work to be included in any sheet-metal course must be limited to some definite part of the work if it is to be of value in preparing students for the local trade.

The Trade and Its Opportunities

The trade name, Sheet-Metal Workers, as more clearly defining the diversified work done by the mechanics, is of comparatively recent origin. It is generally understood that the sheet-metal worker is engaged in the manipulation and fabrication of products made of sheet metal having a thickness of less than 16 gauge. Metal of 16 gauge and heavier belongs to the boilermaker's trade. The work of the tinsmith is included in the classification of sheet-metal worker, since much of the work done by the tinsmith is now the product of factories, while his work as applied to building construction consists of only a very small part of the work done by the sheet-

MOOSEHEART
VOCATIONAL SHEET METAL CLASSES

SHEET METAL COURSE OUTLINE

OUTLINE BY J.A. BRANDT. W.E. MOSHER.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
	USE, CARE, SIZE AND KIND OF HAND TOOLS	USE, CARE, SIZE AND COST OF COMMON STAKES	USE, CARE, SIZE AND COST OF MACHINE	SUPPLIES, KIND, SIZE, USE AND COST	SOLDERING	STRAIGHT LINE LAYOUTS AND CONSTRUCTION OF	CIRCULAR WORK, METHOD OF CONSTRUCTING CIRCUMFERENCE AND DIAMETERS	PATTERN DEVELOPMENT AND CONSTRUCTION OF PRISMATIC SURFACES	PATTERN DEVELOPMENT AND CONSTRUCTION OF FLARING	METHODS OF REINFORCING SHEET METAL	FLASHINGS	GUTTERS	CORNICE WORK	ROOFING AND STEEL SIDING	FURNACE WORK	SLOW PIPE AND CONVEYING	ESTIMATING FROM PLANS	STEEL BUILDING TRIM SASH AND PIPE DOORS	ELECTRIC SIGNS	STEEL CEILINGS AND WALLS	SKYLIGHTS	VENTILATING AND MISCELLANEOUS WORK	TYPICAL CONSTRUCTIONS	
1	SOLDERING COPPERS	HAMMERS STAKES SOLID	SQUARE SHEARS	SOLDERING FLUX	BRIGHT TIN	SEAMS	TRUE CONE	ROUND PIPE SOLDERED LAP SEAM	2 PIECE 4" 90° FOR BOARD PIPE		STRAIGHT AND COUNTER	HALF ROUND HANGING GUTTER	STRAIGHT CORNICE AND MOLDINGS	FLAT LOCKED SEAM	SETTING UP CASE IRON FURNACES	HEAVY GAUGE PIPE CONSTRUCTION	ESTIMATING FOR FURNACES	HOLLOW METAL DOOR FRAMES AND CASINGS	RAISED BLOCK LETTERS	HEATHERING FOR STEEL CEILINGS AND SIDE WALLS	FLAT SKYLIGHTS	ROUND VENTILATORS	GRATES	1
2	TINNERS SNIPS LEFT CUT	HAMMERS STAKES HOLLOW	BAR FOLDER	SOLDERS	GALVANIZED IRON AND WIRE	BISCUIT CUTTERS	FUNNELS	ROUND PIPE GROOVED SEAM WINDOW AND GUTTER	REPEAT 2-1 AT OTHER THAN 90°	DOUBLE SEAMED	STEP AND STEP COUNTER	WALL GUTTERS	MITERS AND RETURNS	STANDING SEAM	SETTING UP SHEET STEEL FURNACES	HEAVY GAUGE ELBOW CONSTRUCTION	ESTIMATING FOR METAL ROOFS	METAL BASE BOARDS AND MOLDINGS	RAISED SCROLL LETTERS	LAYING OUT AND STRAPPING FOR METAL LOUVRES AND SHELLS	SKYLIGHTS	RECTANGULAR VENTILATORS	LENGTH OF DEVELOPMENT PER YEAR	2
3	CROSS CUT SAWS AND BENCH SHEARS	BRASS HORN STAKE	CIRCULAR SHEARS	DIP	BRASS, IRON AND STEEL	ZINC BRUSHES	V GROOVE	ROUND PIPE RIVETED SEAM	3 PIECE 4" 90° FOR ROUND PIPE	WIRED		ROOF GUTTERS	CAP AND BASE CORNICE AND MOULDING	STANDING SEAMS OVER WOOD STRIPS	SETTING UP PIPELESS FURNACES	HEAVY GAUGE PIPE INTERSECTIONS	ESTIMATING FOR BUTTERS, CONNECTIONS, ELBOWS AND VALVES	METAL DOORS AND CASING	CHANNEL LETTERS	APPLYING METAL CEILINGS AND WALLS	SINGLE PITCH SKYLIGHTS	POLYGON VENTILATORS	SPECIALIZED BRANCHES	3
4	RIVETING HAMMERS	ELBOW HORN STAKE	BENCH PUNCH	BLOCK SAL AMMONIAC	BRASS	SUPPLY BOX	CONE SECTIONS AND CAPACITIES	SQUARE PIPE SOLDERED LAP SEAM HOT AND CORNED	REPEAT 1-3 AT OTHER THAN 90°	BAND IRON METAL TURNED OVER	SKYLIGHT AND WINDOW	FLOOR GUTTERS	BAY WINDOW CONSTRUCTION	V CRIMPED EDGE	CASING UP FURNACE	MARKING HOODS AND HOPPERS	ESTIMATING FOR CORNICE WORK	WOOD CORED METAL BASE BOARDS AND MOULDINGS	PANELED SIGNS	ERECTIONS OF CORNICE AND MOULDINGS	DOUBLE PITCH SKYLIGHTS	PATENTED VENTILATORS	HEALTH CONDITION	4
5	SETTING HAMMERS	BENCH PLATES	COMBINATION PUNCH AND SHEAR	RESIN	COPPER	SPREAD AND BANKING PANS	GEOMETRICAL TOOLS ESTIMATING CAPACITIES	SQUARE PIPE GROOVED SEAM ON SIDE	4 PIECE 4" 90° FOR ROUND PIPE		SPECIAL FLASHING SADDLES	DOUBLE WOOD GUTTERS	WOOD FRONTS	CORRUGATED STEEL ON STEEL FRAMES	LOCATING POSITION OF FURNACE AND MAKING	CUTTING GATES AND DAMPERS	ESTIMATING FOR SLOW DUCTS AND CONSTANCE	METHODS OF COVERING WOODEN FRAMES AND DOOR OPENINGS	DEFLECTORS	SECURITIES OF SUSPENDED CEILINGS	HOPPER SKYLIGHTS	LOUVRE VENTILATORS	CHANCE FOR ADVANCEMENT	5
6	WIRE AND PLATE GAUGES	DOUBLE SEAMING STAKE	TURNING MACHINE	RIVETS	ZINC	BURR REAM	SQUARE PIPE DOUBLE SEAMED CORNER	SQUARE PIPE SLIP SEAM	4 PIECE 4" 90° FOR ROUND PIPE	ANGLE IRON METAL TURNED AND RIVETED	FOR WOOD AND COMPOSITION SHINGLE	LINED GUTTERS	SHEET METAL LETTERS ON STORE FRONTS	CORRUGATED STEEL OR WOOD	WALL STACKS	FLOOR SWEEPS	ESTIMATING COSTS ON SLOPING WORK	PERFORATED METAL SASH AND FRAMES	PERFORATED ILLUMINATED SIGNS	ESTIMATING COSTS	VENTILATING SKYLIGHTS	SHIP VENTILATORS	APPRENTICESHIP REQUIREMENTS	6
7	WARING HAMMERS	NEEDLE CASE STAKE	BEADING MACHINE	BOLTS	BLOCK TIN	MAIL BOXES	WIRE EDGING	SQUARE PIPE PITTSBURG SEAM	5 PIECE 4" 90° FOR ROUND PIPE		FOR TIN STEEL ZINC AND COPPER ROOFING	CIRCULAR GUTTERS	PEDIMENTS	METAL SHINGLES	WALL REGISTER BOXES	CYCLONE OR SEPARATOR CONSTRUCTION	ESTIMATING COSTS ON SEPARATOR WORK	DOUBLE SEAMED HOLLOW METAL SASH AND FRAMES			REINFORCED SKYLIGHTS	STACK VENTILATORS	CHANCE FOR EMPLOYMENT	7
8	STEEL SQUARES	HATCHET STAKE	ELBOW EDGING MACHINE	NAILS	SHEET LEAD	ESTIMATING CAPACITIES	FLARING PIPES AND ESTIMATING CAPACITIES	SQUARE PIPE SLIP SEAM	5 PIECE 4" 90° RIVETED 5 INSIDE RADIUS		FOR METAL SHINGLES	GUTTER MITERS	ORNAMENTAL WINDOW AND DOOR CAPS	ZINC AND COPPER	FLOOD REGISTER BOXES	CYCLONE OR SEPARATING ERECTION	ESTIMATING COSTS ON SKYLIGHTS	WOOD CORED TIN CLAD HEAVY DOORS			PUTTYLESS SKYLIGHTS	VENTILATOR PIPE AND JACKS	NEEDS SHOULDER REQUIRED OF APPRENTICE	8
9	DIVIDERS	SQUARE HEAD STAKE	SETTING DOWN MACHINE	BAND IRON	ALUMINUM	BREAD AND CAKE BOXES	FLARING PIPES ESTIMATING CAPACITIES	SQUARE PIPE LOCK SEAM ON SIDE AND CORNER	6 PIECE 6" 90° RIVETED 5 INSIDE RADIUS		SKATE AND FILE	EXPANSION JOINTS		CIRCULAR AND DOME	STACK BOOTS	TESTING SUCTION VELOCITY	ESTIMATING VENTILATION AND INDIRECT HEATING	UNDERWRITERS SPECIFICATIONS FOR PIPE DOORS			SAW TOOTH SKYLIGHTS	VENTILATOR BASES AND DAMPERS	FUTURE OF THE TRADE	9
10	WIRE CHISELS	DOUBLE SEAMING STAKE WITH FOUR HEADS	CRIMPING MACHINE	ANGLE IRON	BRONZE WORK	DRAWING CUPS	PIPES ESTIMATING CAPACITIES	PIPE CONSTRUCTION	GROOVED SEAM ON SIDE AND CORNER		TIN SHELF UP COMPOSITION ROOFING BLIND					DUST COLLECTING SYSTEMS IN WOOD MILLS	ESTIMATING FOR PIPE DOORS ETC.				SKYLIGHTS	HEATER COIL HOUSING	UNDESIRABLE CONDITIONS	10
11	SOLID PUNCHES	ROUND HEAD STAKE	BEADING MACHINE	WIRE	VERTICAL SEAMS	ROUND DRIP PANS	CONE SECTIONS	1" ROUND PIPE 2" INTERSECTING 2" AT 90° ANGLE	4"-6" ELBOWS 90° ANGLE			CONDUCTOR PIPE	MODILLIONS AND DENTILS	VALLEYS	INSULATING WARM AIR PIPES	FOR HEATING PLANTS IN CEREAL MILLS AND GRAIN HOUSES				CIRCULAR SKYLIGHTS	MIXING DAMPERS		11
12	PUNCH AND CENTER PUNCHES	CHEASING STAKE	WIDENING MACHINE	TIN PLATE	BOTTOMS	MATCH BOX	OVAL PANS ESTIMATING CAPACITIES	1 ROUND PIPE 1½" INTERSECTING 2" AT 90° ANGLE	RECTANGULAR 90° ANGLE		FOR STONE CHECKS BRICK AND TERRA COTTA WORK	CONDUCTOR FITTINGS	PRESSED ENRICHMENTS	RIDGE ROLL	RETURN AIR PIPE AND ELBOWS	DUST COLLECTING SYSTEM IN METAL MILLS					MANSARD SKYLIGHTS	AIR WASHERS		12
13	SCRIBES	CONDUCTOR STAKE	GUTTER BEADING MACHINE	TEXINE PLATE	NICKEL PLATED ZINC	WRIST BROOM HOLDER	CYLINDRICAL CANS	ROUND PIPE 2" OR 2½" AT OTHER THAN 90°	5 PIECE V, 10" BETWEEN V FOR ROUND PIPE		ATTACHING TO STEEL BEAMS AND COLUMNS	CONDUCTOR HEADS	TERMINALS FINIALS AND PINNACLES	HIP COVERING	RETURN AIR DUCTS	BLAST PIPING IN FOUNDRIES AND STEEL MILLS					PHOTOGRAPHIC STUDIO SKYLIGHTS	HUMIDIFIERS		13
14	CUTTING NIPPERS	BOTTOM STAKE	GROOVING MACHINE	GALVANIZED STEEL	NICKEL PLATED COPPER	APPLE CORER	CLOTHES SPRINKLER	ROUND PIPE TO FIT 2" AT OTHER THAN 90°	5 PIECE 9 OFFSET V, 10" BETWEEN V FOR ROUND PIPE			OVERHYDRAL CONDUCTOR STRAP	ESTIMATING COST OF MATERIAL AND LABOR	PRESSED METAL SIDING STONE AND BRICK	RETURN AIR SHOES	CONVEYING SPOUTS AND PIPE ELEVATORS					DRILLING FOR THEATER SKYLIGHTS	GRAVITY SYSTEMS		14
15	MALLETS	RIVETING ANVILS	CORNICE BRAKE	GALVANIZED IRON	LAP SEAMS	ICE CREAM MOLDS	SAND SPRINKLER	V ROUND PIPE 90° BETWEEN LEGS	REPEAT 1-14 FOR SQUARE PIPE			CONDUCTOR FITTINGS	PRESSED ENRICHMENTS	SHOP MADE SIDING	SMALL PIPE AND ELBOWS	ESTIMATING COST OF MATERIAL AND LABOR					POLYGON SKYLIGHTS	FAN SYSTEMS		15
16	HOLLOW PUNCHES	GROOVING STAKE	FORMING ROLLS	BLUE ANNEALED STEEL	FLAT LOCKED SEAMS	TUNNELS DRAINER	FLOUR SIFTER	ROUND PIPE INTERSECTING PLANE AT 45° ANGLE	4 PIECE 90° 6" TAPERING FOR ROUND PIPE			ESTIMATING COST OF MATERIAL AND LABOR			FURNACE REGULATORS CHAINS AND DAMPERS	METHOD OF HANGING LARGE PIPES					DEVELOPMENT AND CONSTRUCTION OF H.I.P. & R.	STRAIGHTENING CHANGING OF PIPE FITTINGS AND RIVETING		16
17	RIVET SETS	TEA KETTLE STAKES	HEM FORMING ROLLS	THE FINEST COLD ROLL STEEL MADE AND ANNEALED			VARIATIONS	CONCENTRIC SET PLATE OVER ENDS OF BODY	REPEAT 9-16 FOR SQUARE PIPE						BRICK SET PURPACES	CALCULATION CAPACITIES OF PIPE AND FITTINGS						TESTING HEAT, HUMIDITY AND VELOCITY OF AIR		17
18	PLIERS	STAKE HOLDER	DOUBLE SEAMING MACHINES	SPECIAL SHEETS			COLANDER	ROUND PIPE INTERSECTING DIAGONAL PLANE	4 PIECE 90° 6"-4" SQUARE TO 3" ROUND						ESTIMATING CAPACITY OF PIPE PITTSBURG AND ELBOWS	CONSTRUCTION OF THE AREA						ESTIMATING COST OF MATERIAL AND LABOR		18
19	FILES	CANDLE MOLD STAKE	MACHINE STANDARDS	COPPER SHEETS			FRUIT JAR FILLERS	ROUND PIPE INTERSECTING CONE SLOPE PLANE	3 PIECE 90° ROUND TO OBLONG						STANDING SEAM CHIMNEY REQUIRED									19
20	GROOVERS	CORNER SMITHS SQUARE STAKE	THROATLESS SHEARS	ZINC SHEETS			MILK STRAINER	ROUND PIPE 10"-12" IN 5" 90° ANGLE BETWEEN Y	5 PIECE MOUTH TO ELLIPTICAL						ESTIMATING SIZE FURNACE REQUIRED									20
21	SWABS	BEAK, EDGE SQUARE STAKE	SQUARE JAW AND BOX FORMING MACHINE	SHEET LEAD			JAM DRAINER	ROUND PIPE 8"-10" INTO 5"	TAPERED RECTANGULAR BOTTOM 2"×4" TOP 1¾"×3¼"						FURNACE RATINGS									21
22	SCRAPERS	BATH TUB STAKE	SLITTING SHEARS	SHEET BRASS				ROUND PIPE 1¾"×2"×2¾" INTO 5"	TAPERED RECTANGULAR CORNET TOP 15"×5" BOTTOM 2"×6"						ESTIMATING COST OF INSTALLATION ON NEW WORK									22
23	CIRCUMFERENCE RULES		BRAKE AND WIRE BENDERS	SHEET ALUMINUM				REPEAT H-11 FOR SQUARE AND RECTANGULAR PIPE							ESTIMATING COST OF REPLACEMENT AND REPAIR WORK									23
24	SCREW DRIVERS		WIRE CUTTER	NICKEL PLATED ZINC SHEETS				REPEAT H-12 FOR SQUARE AND RECTANGULAR PIPE																24
25	DOUBLE CUTTING SHEARS		WIRE REELS	NICKEL PLATED COPPER SHEETS				REPEAT H-13 FOR SQUARE AND RECTANGULAR PIPE																25
26	HANDY SEAMERS		BENCH VISES	BAND BRASS				REPEAT H-14 FOR SQUARE AND RECTANGULAR PIPE																26
27	PORTABLE PUNCHES		SCROLL SHEARS					REPEAT H-15 FOR SQUARE AND RECTANGULAR PIPE																27
28	HAND PUNCHES		PANEL FRAMERS					REPEAT H-16 FOR SQUARE AND RECTANGULAR PIPE																28
29	SQUARE PIPE CRIMPERS		FLANGING MACHINE																					29
30	GLAZIER'S TOOLS		SWEDGES																					30
31	TINNERS SNIPS RIGHT CUT		TIN MACHINE																					31
32	TROJAN SHARP POINTED SNIPS																							32
33	FLANGING HAMMERS																							33
34	STEEL STRAIGHT EDGES																							
35	DOUBLE CUTTING SHEARS																							

FIGURE 1. MOOSEHEART STUDENTS ARE GIVEN PRACTICAL EXPERIENCE ON REPAIR WORK FROM SOLDERING A RADIO SET TO RELINING AND RECONDITIONING REFRIGERATORS.

metal worker. The discussion in this paper is limited to the work of the sheet-metal worker.

Regardless of the trade name applied to the mechanics who do this work, the future of the trade is unlimited. Increasingly more sheet metal is being used in the construction of both large and small buildings than ever before. The amount of sheet metal that will be used in the construction of buildings of the future will depend greatly upon the ability of contractors to furnish skilled mechanics capable of doing the work efficiently and at reasonable cost.

Sheet-metal work on the outside of large modern buildings, regardless of type, consists of only a small part of the total work to be done. On the inside of the building the sheet-metal worker installs metal ceilings and side walls, conveyors, heating and ventilating systems, and in some localities the metal windows, doors, and trim, and many other items or specialties. All of this work is of such nature that it can be done only by experienced workmen.

The trade taken as a whole is worthy of the skill and knowledge of the highest type of mechanics. To this class of workmen it offers financial returns and opportunities for rapid advancement, which compare favorably with the highest-paid trades. The increasing demand for sheet-metal workers, high wages, and short hours, and keen competition, form a combination of conditions, which has practically eliminated the training of apprentices from jobbing and contracting shops. This condition has existed for a number of years, and the results are to be in the prevalent shortage of skilled workmen. Employers interested in the future of the trade are making every effort to find a satisfactory way of securing and giving apprentices the technical training they should have to become the types of mechanics needed. Regardless of the efforts now being made to overcome this condition, it will be a number of years before the results will be of material value.

The Boy and the School's Problem

Many employers have been forced to train a class of workmen known as "handy men," their work being comparable to that of the "hatchet-and-saw carpenters," so well known in the building trades. The type of work that can be done by these men is so limited that their work offers little in the way of overcoming the shortage of skilled mechanics.

The first and probably the most difficult step to be made in overcoming this shortage is to locate the type of boy who can be interested and given the necessary training. This boy should have at least a sixth-grade education; he must not be too small, and he should possess considerable natural mechanical ability. The subnormal or mentally deficient will not do.

The most logical place to find this boy is in the schools, and the training of these future mechanics rightfully belongs in the schools where he can be given not only the trade training, but also the academic subjects that will remove limitations which prevent him from advancing to the higher positions of the trade. Few trades now taught in school shops are as adaptable to school conditions as is the sheet-metal trade, and few can offer the vocational graduate greater opportunities for employment and rapid advancement.

The variety of the work covered by the trade is so great that practical problems can be selected and incorporated in courses for students in manual-arts or household-mechanics classes as well as in courses for vocational and part-time apprentices. The same shop and equipment is adaptable for all classes.

The work selected for prevocational, tryout, and industrial-arts classes of students can be the elementary work of the vocational classes. Another important feature of this work, when considered from an educational standpoint, is the fact that results in the construction of articles of sheet metal are quickly attained, making the task of securing and holding the student's interest a minor responsibility of the teacher.

The shopwork offers unlimited opportunities for correlation with such academic subjects as arithmetic, algebra, plain and solid geometry, and science. The cost of supplies and equipment will be found reasonable when compared with similar costs for other trade work in school shops.

The Content of Courses

Before the content of any vocational sheet-metal course can be considered, it is necessary that the work to be covered be limited to some definite branch of the trade. The chart clearly shows the impossibility of including in such courses all of the work listed as belonging to this trade. The method used in establishing this limit and in selecting the class of work to be included will be shown later.

Under a number of the alphabetical headings in the chart, elementary work to be included in all courses is listed in detail, while under other headings is listed work properly classified as belonging to the trade, as specialties. For example, some shops limit their work to one or more of the classifications listed under O, P, R, S, and U, which are some of the most common divisions considered as specialties. Because these divisions are held in some sections to be specialties does not mean that they are to be eliminated from trade courses—the fundamental principles must be covered.

Regardless of the time any student will spend in a school shop, more than a reasonable amount of his total time could

FIGURE 2. A LARGE STOCK OF ARTICLES COMMONLY USED BY MOOSEHEART IS MADE UP DURING THE ELEMENTARY STAGES OF THE STUDENTS' TRAINING.

be devoted to any one of these classifications of the work without thoroughly covering it in every detail. Much of the technical data applying will start in trade work and end in engineering. Schools cannot be justified in training students for the special branches of the trade, except possibly in the case of part-time students and apprentices. As a rule the type of work a student will do when he graduates cannot be predetermined. The following conclusions are based upon a study of the work of the sheet-metal trade and the results of the survey:

Some General Principles

1. There are more sheet-metal shops doing the class of work applied to general building construction than there are specialty shops. These shops are known as general contracting or jobbing shops, and they are equipped to do all sheet-metal work required on any type of building and all kinds of miscellaneous jobs.

2. There are more men employed in the general shops than there are in specialty shops, and as a rule at higher wages.

3. The greatest demand for more skilled workmen is found in the general shops, consequently these offer a greater chance for the vocational graduate.

4. High wages paid for unskilled labor have made it difficult for the shop owner to find boys who will work for wages that will make it financially possible for the employer to teach them the trade in the shop.

5. The cost of training one or two apprentices at a time in the shop is so great that this method is no longer practical.

6. It is evident that all of the work listed in the chart cannot be covered in detail in the vocational classes. It is also inadvisable to discard entirely one or more of the classifications, since at one time or another all of the work will be done in the general shop.

7. In every class of sheet-metal work there are certain fundamental principles of construction, pattern drafting, and technical data that will apply to any work listed under any one of the general classifications.

FIGURE 3. GENERAL VIEW OF ONE HALF OF THE SHOP.

8. The work to be included in sheet-metal courses should be based upon problems and projects that will best illustrate the fundamental principles of construction, and apply the technical data to the largest possible number of the most frequently occurring jobs found in sheet-metal work applying to the building trades.

9. It is not practical or desirable to limit the work to be covered in the school shop to the few problems that can be selected for reproducing in the school shop the actual conditions of construction governing the work.

FIGURE 4. VIEW OF THE SAME SIDE OF THE SHOP, SHOWING THE PATTERN DRAFTING-ROOM EQUIPMENT.

10. Teaching the trade by placing students on buildings under construction has proved impractical for the following reasons: (a) The number of students that can be placed on any job will be limited. (b) Only the most advanced students can be used with any degree of success. (c) The time of doing the work cannot be controlled or delayed to give the students this experience at the proper time. (d) As a rule, the available jobs of this kind will not offer enough variety to make the work of any great value from an educational standpoint. The same class of work will occur so often that the student will devote more of his time to the one class of work than is necessary or desirable.

Production Work vs. Educational Projects

11. Production work in the school shop will have value only in so far as the articles made will develop skill and speed in the use of the tools and machines.

12. Regardless of the completeness of the equipment or how efficiently the work is covered in the school shop, the final training of the student must become the responsibility of the employer, and this training must be given on the job under actual working conditions.

13. A vocational sheet-metal course should include work that will present to the student in the most practical way the following problems or basic knowledge of the trade:

(a) Fundamental principles applying to the various methods used in developing pattern.

(b) Apply the patterns developed in doing work or making articles and models that will develop skill in the use of the tools and machines and best illustrate practical forms and methods of construction.

(c) A general idea of methods used in estimating sizes and cost of materials used and work done.

(d) A thorough knowledge of all materials and supplies used.

(e) To think and reason in technical terms and to be able to apply academic knowledge to the work of the trade.

Any vocational sheet-metal department that will satisfy these requirements within any reasonable degree of completeness will have fulfilled its obligation to the students and the future employers of these students. It will then become the duty and obligation of the employers and the mechanics with whom the students will work, to see that they are given a chance to apply the knowledge they have worked hard to secure, and to teach and bear with them until they acquire speed.

It will be the purpose of another article to show methods of accomplishing the required results.

TRAINING GENERAL SHOP TEACHERS

Harry E. Wood, Director of Vocational Education and Manual Training, Indianapolis

That the general shop is going to meet a real need in the industrial-education program of the future cannot be denied, for experiments conducted in many cities have proved its worth. The advantages of such a shop over the regular manual-training shop need not be reviewed in detail, since general shops have been discussed from time to time in the school magazines.

The general shop to be a real asset in the educational program must have excellent teachers, teachers of initiative, teachers who have had a wide range of experience in a variety of crafts, teachers who can apply their technical skill in an elementary way in the construction of projects adapted to pupils of varying abilities and interests. The normal schools and colleges have not been able to cope with this new situation in supplying good general-shop teachers in sufficient numbers to meet the need. As a result many communities have not yet reorganized their work on a general-shop basis for fear of not being able to hire good teachers after the organization is complete. Some localities have established general shops and have seemed to prosper until some other locality which could pay higher salaries, enticed the teacher away. Then the prosperous general shop became a poorly equipped manual-training center because the new teacher could handle only certain phases of the work and thus, that which offered great promise took its place in the rear instead of the front ranks in educational advance.

One of the great difficulties in a general shop is getting the class started. It is here that many a teacher finds he is not a general-shop teacher. No matter how well a teacher may know his subjects or how successful he may be in the manipulation of tools and materials, he must be efficient as an organizer to start simultaneously, let us say 24 boys, in four to six kinds of work. The solution of this problem, of course, is the individual lesson sheet which can be placed in the hands of the pupil along with materials sufficient to meet the requirements of the problem which he is undertaking. If the lesson sheet is used and a few brief demonstrations are given, the entire class can be put to work and the teacher can circulate from group to group or from individual to individual, with a criticism here, a check there, and a suggestion where most needed, leading an entire class enthusiastically into its work.

The general difficulty encountered is that of securing individual lesson sheets in sufficient quantities to carry on the work. One lone teacher in the time available cannot write enough to supply even a portion of the subjects which should be covered. True it is, there are on the market many valuable sets of lesson sheets relating to different kinds of work, but experience has proved to many who have tried to use them that not all are adapted to particular situations in different localities and, therefore, they are inadequate.

There was a desire on the part of those in authority in Indianapolis to establish a few general shops, but a survey of the foregoing facts led to the belief that difficulty would be encountered at the outset and perhaps the experiment would not be successful. Attention was then turned toward removing the difficulty. Correspondence and conferences were held with the teacher-training division of Purdue University and a plan was evolved whereby manual-training teachers already in service could be given general-shop-teacher-training work. Before the class was started a well-defined plan was developed for the work to be undertaken. This plan was as follows: (a) At least two semesters of work (on an extension-class basis) were to be undertaken. (b) Seventeen lessons were to be given in each semester. (c) The work was to consist of the manipulation of tools and materials in the construction of projects suitable to pupils of seventh and eighth grades; reading and research relative to the problems involved; preparation of individual lesson sheets which would be suitable to place in the hands of seventh and eighth grade boys. (d) Three different kinds of work were to be undertaken each semester with teachers who were specialists in their lines, these teachers working under the supervision of and according to plans prepared by a professor from Purdue University.

Professor A. Swope was chosen to take the class and after repeated conferences with the writer, who is director of vocational education and manual training in Indianapolis, plans were approved, sample lesson sheets prepared, teachers employed, and announcement made that the class would begin. A total of 33 of the 44 teachers employed in the grade school manual-training work attended the first meeting and became members of the class. At this meeting the aims of the general shop were set forth and discussed.

The second, third, fourth, and fifth meetings were held in the sheet-metal shop at Technical High School with the vocational teacher of sheet-metal instructing. Blue prints of projects suitable for seventh and eighth grades were furnished and these projects were made by each member of the class. The writing of lesson sheets was begun.

The sixth, seventh, and eighth meetings were held in the patternmaking room at Manual Training High School with the patternmaking teacher instructing.

The ninth and tenth meetings were held in the foundry at Technical High School under the direction of the regular foundry teacher. Castings were made from the patterns developed in the preceding lessons.

The eleventh, twelfth, thirteenth, and fourteenth lessons were carried on in the vocational electrical department with the head of the department in charge. Bell-wiring diagrams and the wiring of simple lighting circuits were undertaken.

Lessons fifteen and sixteen were held in the teachers' room of the school administration building. These lessons were devoted to a general summing up of the work of the semester preparatory to the final examination which was given during the seventeenth lesson.

Three types of lesson sheets were prepared: Information, operation, and job sheets. The information sheets had to do with information about materials and about the subject studied. The operation sheets set forth in logical order the manner of performing fundamental practices. The job sheets consisted of four parts: (1) the general statement of what the job was to be, in other words, a specification; (2) the order of procedure, the operations necessary step by step, to complete the job; (3) questions which would help a student to evaluate or appraise his own work; (4) questions which would test a student on the information and operation side of his work.

In preparing the lesson sheets, the same subjects were assigned to at least two persons, with instructions that they were to work independently. From these lesson sheets a composite was made, using the best from each. These final lessons were mimeographed and distributed to the members of the class. At the end of the semester each member of the class possessed 55 information sheets, 46 operation sheets, and 28 job sheets, a good beginning for a library in a general shop, since the items covered had direct bearing on the subjects and projects suitable for use in the general shop.

The work of the second semester consisted of a second unit of sheet-metal work, a unit of foundry work, and a unit

of concrete work. As in the work of the first semester, projects undertaken were suitable for use in the seventh- and eighth-grade shops.

The work of the third semester consisted of two units of work, one on design and construction of woodworking projects, the other on wood finishing. Ninety-six lesson sheets are in preparation during this third semester.

By this organization experience has been given and material has been accumulated far beyond the expectation of those who were responsible for promoting the idea. The accompanying examples of lesson sheets are typical of the kind produced during the course.

MOLDING

Specification: Making a bud vase from a split pattern.

Materials:

Job Sheet—M—No. 2.

Split pattern	Follow board
Flask	Molder's tools
Sand	Metal

Application: A bud vase made of metal may be used with a test tube for flowers or buds.

Procedure:

1. Prepare sand. Information sheet 3B.
2. Ram up mold. Op. No. 3.
3. Remove pattern from mold. Op. No. 3.
4. Pour metal. Op. No. 2.
5. Clean project by filing. Op. No. 8.
6. Finish project with sandpaper and enamel as desired. Op. No. 9.

Appraisal: A+ A B C D

1. Is your bud vase correct in shape and size?
2. Are there any shrink holes?
3. Was your mold broken or in good condition after removing pattern?
4. Did your mold crack?
5. Is the parting edge too pronounced?
6. Is mold rammed up evenly?
7. Was your sand tempered correctly?

Questions:

1. What is molding sand? Inf. No. 3B
2. How is molding sand tempered?
3. How are cores made? Inf. No. 3C
4. What is a core box? Inf. No. 3C
5. What is a follow board? Inf. No. 2
6. What is the "drag"? The "cope"? Inf. No. 2

Name ..... Date begun .....
Address ..... Date finished .....
School ..... Time consumed .....
Teacher's grade—on Project ..... on Question .....
Signature of teacher .....

MOLDING

Foundry Materials *Information Sheet—M—No. 3*

A. Metals:

Castings or moldings may be divided into three classes, each having distinct physical properties, suiting them to their several needs.

The classes are:

1. Gray iron
2. Alloys { Brass, Bronze, Bell metal
3. Mild Steel

1. Gray Iron:

The greatest number of castings are made of gray iron, that is, iron which may be machined as it comes from the mold without further treatment.

If gray-iron castings are subjected to heat treatment they take on several desired characteristics, (a) it is more tensile, (b) elasticity is increased, (c) it is more resistant to shock. After heat treatment they are known as malleable castings. The melting point of gray iron varies with its chemical composition.

2. Alloys:

a. Brass (common).
Brass is composed of 10 lbs. zinc, 3 oz. lead and 24 lbs. copper. Its melting point varies from 1500° to 1800° F.

b. Bronze.
Bronze is composed of 1 lb. antimony, 100 lbs. tin and 2 lbs. copper. Its melting point is 1900° F.

c. Bell metal.
Bell metal is composed of 30 lbs. copper, 5.6 lbs. zinc, 10 lbs. tin, and 4.3 lbs. lead. Its melting point varies with the proportion of the metals in its mixture.

Note: The mixture of alloy is varied to meet special needs.

3. Mild steel

The use of steel castings has developed rapidly in the last few years. These castings are taking the place of drop forgings, especially in marine and engine construction. The principles of molding involved are the same as in other classes but are varied to meet conditions.

B. Sands:

Good molding sand is found along the rivers and lakes in many parts of the United States. Albany, New York, Sandusky, Ohio, and Ottawa, Illinois, are well known molding-sand centers.

Molding sand must be cohesive when moistened to the proper degree of dampness and rammed to a sufficient hardness. It must be refractory enough to stand high temperatures. It must be porous in order that the steam and gases generated by pouring may escape. A good sand will also bake a little when heated.

It must also have the proper amount of chemicals when analyzed.

It may be divided into three classes or grades on the basis of size of grains and use with reference to castings.

Light
Medium
Strong

Parting sand is a fine sand made free from vegetable matter and clay by various processes. It should contain no bond. There are natural parting sands on the market. Others are obtained from used molding material.

Burnt molding sands furnish a large supply of parting sands.

Core sands must be quite refractory and very free from clay. An artificial binder is usually added. The most common binders used in core-making are ordinary wheat flour, rosin, linseed oil and glue.

MOLDING

Ramming Mold for Solid Pattern *Operation Sheet—M—No. 1*

A.

1. Place molding board upon bench with cleats in position to act as skids over edge of bench.
2. Place drag on molding board with pins of drag down.
3. Place pattern on molding board, near center. (Position determined by draft.)
4. Temper sand.
5. Riddle sand over pattern to cover it to a depth of one inch using No. 6 riddle.
6. Press sand around edges of pattern against molding board with fingers.
7. Shovel drag heaping full of molding sand.
8. Peen ram around edges of flask first and butt ram remainder. Do not ram too hard over pattern.
9. Again fill drag heaping full and butt ram it nearly even with edge of drag.
10. With straight edge strike off even with edges of drag. Throw sand, free of lumps, over drag to depth of ¼ inch.
11. Rub bottom board diagonally on sand until it lies on drag without rocking.

B.

1. Grasp molding and bottom board at the ends with both hands, holding drag firmly between boards.
2. Drag over to edge of bench, lower it until bottom board is below edge of bench and roll over on bench.
3. Take off molding board.
4. With bellows blow all loose sand from drag.
5. Sprinkle parting sand over surface of drag.
6. Blow surplus sand from drag.

C.

1. Place cope on drag and see that pins fit in sockets. (If using snap flask place snaps at same corner.) If loose, slide to one corner.
2. Set sprue pin 1½" from pattern.
3. Riddle sand to depth of 1" over pattern.
4. Fill cope heaping full of unsifted sand.
5. Ram cope same as drag.
6. Strike off even.
7. Remove sprue pin and form top of hole to funnel shape.

D.

1. Lift cope and place it on molding board, with impression taken from drag uppermost.
2. Blow off loose sand.
3. With sponge swab sand next to pattern with water, being careful not to get too wet.

E.

1. Drive draw spike into pattern, rap lightly on all sides with rapping bar, and lift evenly.
2. In case of broken edges patch with sand properly rammed, using Yankee slick or spoon.
3. With gate cutter, cut gate from sprue hole to pattern impression, size depending upon size of impression.
4. Clean out all loose sand.
5. Core mold by placing cope on the drag with pins in sockets and cope pressed toward same corner position as that which rammed it.

F.

1. Remove flask.
2. Place weight upon mold.

BOOK TROUGH DESIGNED AND MADE IN CLASSES OF ARTHUR E. BIDNEY, SHOREWOOD, WIS.

"IRON SHARPENETH IRON"

W. C. Wright, Philadelphia, Pa.

GRUBBY hands, with impatient energy, are rubbing some tightly-clutched stone against the schoolhouse wall. Other hands are similarly busy on the concrete pavement. If you draw closer, you see that peachstone whistles, watch charms, and baskets are being filed out by youngsters, with determination in every tongue-bulged cheek. While the rough, stone surfaces act as files, closer inspection shows an equivalent production of blisters.

Imagine prehistoric man, bent over a sandstone rock, shaping a reindeer bone into a spearhead. Visit the South Sea islands where today pieces of coral are used for files, or see the Yucatan Indians of Mexico using the dried tail of a rakefish as a wood rasp. In the snowbound north, the Eskimos still fashion fishhooks of bone by abrasion on stone.

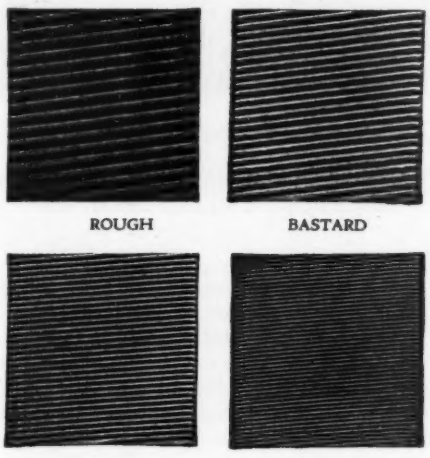


FIGURE 1. SPACING OF TEETH ON SINGLE-CUT FILES.

Before metal was known, filing was a natural means of shaping primitive tools and weapons. While ancient Egypt has left us examples of bronze rasps, the Assyrians are thought to have been the first to make a file of hardened iron. Traced over years of stone, bronze, iron, and steel, the file remains the tool for shaping material not readily cut or molded.

Bearing its Anglo-Saxon name "feol," this tool comes to us arrayed in a multitude of shapes, carrying terms that recall the crudities of the first workshops. Indeed, it was but a few years ago that the hand product of artisan file cutters was held to be better than the machine-made file. Filing is so closely linked to primitive efforts in construction that we dismiss it with a superficial thought, until the day it is taken up as a step in machine-shop practice.

A file can be *defined* as a strip of hardened steel, on the faces of which are cut evenly spaced teeth, in such a manner that when the file is rubbed over materials less hard than itself, it will shear or abrade their surface.

Files are properly classified by name, spacing of teeth, and length. The *name* can be traced to cross section, general outline, or use of the tool. We find the names round, square, flat, half-round, lozenge, feather-edge, oval, and diamond files, based on their sectional contour. The outline of the tool lengthwise results in certain files being called: taper, pillar, arch, and knife. The specific use of some files accounts for the terms: mill, hand, lathe, auger-bit, drill, planer-knife, lock, slotting, valve, magneto, hand-saw, and warding files.

The second specification, *spacing* of teeth, refers to arbitrarily assigned names which designate the degree of fineness of teeth. There are six graduations from rough to dead-smooth. All that need be remembered are rough, bastard (interposed between an original rough and smooth spacing), second cut (not meaning recut, but referring to a second interposed spacing between rough and smooth), and smooth. On a 12″ file, these spacings are in general about 15 teeth to the inch for rough, 22 teeth to the inch for bastard, 30 teeth for second-cut, 45 teeth for smooth, and 90 for dead-smooth. Files of finer graduation than these, usually known as superfine, range from 40 to 200 teeth per inch, and are numbered 00, 0, 1, 2, 3, 4, 5, 6, 7, and 8 to indicate their increasing fineness.

The third specification—*length*—is measured from the point of the file to the beginning of the tang. The two other dimensions of files, width and thickness, are proportional to the length. For example, a 4″ flat file is $\frac{7}{16}$″ wide and $\frac{5}{64}$″ thick, while a 6″ flat file is $\frac{3}{8}$″ wide and $\frac{5}{32}$″ thick.

Spacing of teeth must not be confused with type of cut, by which is meant single- or double-cut. A *single-cut file*, shown in Figure 1, has a parallel series of oblique chisel edges. A *double-cut file* has a first, or "overcut," with a second superimposed and diagonal cut, the "upcut," forming a surface of staggered cutting points, illustrated in Figure 2. Practice has rather definitely assigned the type of cut to the name of the file. For example, a mill file is always single-cut; a hand file is double-cut; while a round file is single-cut to 8″ length, and double-cut in lengths greater than that. For this reason it is not necessary to designate whether a file be single- or double-cut.

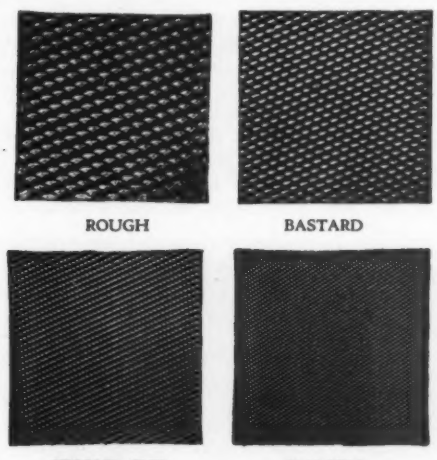


FIGURE 2. SPACING OF TEETH ON DOUBLE-CUT FILES.

It is well at this point to study the *cutting action* of this tool. The cross sections of single-cut files disclose that their surface, while somewhat similar to rip-saw teeth, is more exactly comparable to a series of upright skew chisels. The obliquity of the teeth aids in both the shearing action and in keeping the spaces clear of filings. In double-cut files the first cut is about the depth and angle of a single-cut file, while the second cut, or "upcut," is of just sufficient depth to break up the chisel teeth into a surface of diamond-shaped points.

* Photographs taken at Frankford High School, Philadelphia, Pa. Courtesy of Henry Disston & Sons, Inc.

FIGURE 3. BENCH FILING. NOTE POSITION OF HANDS AND HEIGHT OF WORK.

If you will look down the face of a double-cut file you will note that these cutting points are not quite parallel to the length of the file, thus further aiding the cutting action of the tool. Comparing the cutting action of single-cut and double-cut files, the single-cut, being more chisel-like, cuts smoother, while the double-cut, with rasplike points, removes material more rapidly.

Any description of the cutting action of files would be incomplete, which did not call attention to the fact that the surfaces of most files are not plane but convex. Files, such as slotting, with decided fullness in the center are sometimes described as "bellied." By glancing lengthwise of a file, so as to sight along its thickness, the amount of *convexity* can be noted. It is this arc which permits the removal of material from a particular area of a surface, as well as bringing a portion of the teeth into cutting throughout the stroke of the file. Files, such as the mill, which taper in outline, are often made with straight sides and are then termed "blunt." However, a slight convexity is also generally ground into blunt files.

FIGURE 5. LATHE FILE TURNED TOWARD HEADSTOCK.

To select a file requires knowledge of the *types available*. Any filing job can be divided into the processes of (1) removal of surface (castings); (2) rapid removal of waste; and (3) finishing cut. If the surface is to be plane, it at once suggests use of hand, flat, or pillar (double-cut) files; or, a mill (single-cut) file. If the surface is concave, the back of a half-round file is usually suited to the work. Gullets and keyways call for square and pillar (double-cut) files. For enlarging round holes, a round file is at times as effective as a broach or reamer. Tools are sharpened by mill and taper files. The unlimited variety of curved surfaces precludes more than a suggestion of the file needed.

FIGURE 4. FOR DRAW FILING HOLD AS SPOKE-SHAVE.

FIGURE 6. HANDSAW FILING WITH SLIM TAPER FILE.

FIGURE 7. FILING A KEYWAY.

A *handle* should be placed on the file before using. This is the first step in accident prevention, as the tang is pointed enough to be dangerous. During the annealing of the tang, a cyanide solution is used, which renders any cut or scratch septic. The handle with its drilled hole should be large enough to house the tang without danger of splitting. After starting the tang into the hole in the handle, tap the butt end of the handle on the bench until the tang is completely embedded.

Grasping the handle naturally is attended by demonstrating with a file lying on a bench, with the handle projecting over the edge toward the operator. Raise the forearm so as to pick up the file naturally, thumb on top, the handle in the ball of the hand, held by the normal grasp of the fingers.

The left hand is used to guide the direction of the tool. Generally the point of the file is clasped by the thumb and index finger and lies on the second finger. In very heavy filing, the end of the file is pressed down by the ball of the hand, palm down.

When it is necessary to hold the file in one hand, as in sharpening small tools, the forefinger is extended along the back of the file, beyond the ferrule of the handle, as indicated by Figure 7.

The *height of work* which is least exhausting for general filing is slightly below the level of elbows, usually about 40" from the floor. If the pressure is to be greater for fast removal of material, the piece is placed lower to bring more of the operator's weight on the stroke. Lathe and hand-saw filing are higher than normal, as indicated in Figures 5 and 6. In all cases the body position of the filer must be as easy and natural as the size and conformity of the work permits.

More important than the proper height is the secure *fastening* of the work in the vise to avoid chattering. If the piece moves, the file will be worn out rapidly and the teeth will dig in and leave marks on the surface of the piece.

With the work secured at a proper height, the operator is now ready to consider *stroke*. Filing is done with full motion of the arms from the shoulder. The motion of the right arm, which tends to raise and lower the file during the stroke, is counterbalanced by motion at the elbow of the left arm. The work, acting as a fulcrum, aids in guiding the stroke, but it requires practice to maintain a straight path of action. All filing is started near the point of the file, pressure being first applied by the left and gradually transferred to the right hand as the stroke progresses. "Riding" the file—that is, exerting undue downward pressure—causes the surface of the file to arc concavely, and tends to round the flat surface of the work. Also rocking the file during stroke results in an arched surface.

Pressure should be just sufficient to keep the file cutting, and yet not choke the teeth spaces with chips. If faster cutting is desired, use a double-cut file, one with coarser teeth, or a longer file of the same graduation. New files should be given less pressure until the teeth become slightly worn. The length of stroke can be three quarters of the length of the file, thus accomplishing a better job with a slower, more uniform motion.

The file must be kept in contact throughout the forward stroke, but should be raised from the work on the return. The extreme hardness of the teeth and their inverted V shape cause the point of the file to chip off if pressure is applied on the return stroke.

A division of general filing practices might be made into benchfiling, drawfiling, lathefiling, and tool sharpening. *Benchfiling* is illustrated in Figure 3, where a 12" flat file, bastard-cut, is being used to remove ⅛" of stock from a cast-iron block. Note the proper grasp of the file handle, the correct height, the secure clamping of the block, and the natural position for full, even strokes. Although the cast-iron block has been "pickled" to remove its sand-chilled surface, as a precaution a worn file is first rubbed over the surface to remove any remaining spots of the hard shell. Otherwise the sharp teeth of a new file are quickly dulled on castings. On other than flat surfaces filing must make the curves continuous rather than a series of small areas. The joining arcs should be filed so as to merge the filed surfaces evenly.

Drawfiling is moving the file sidewise across the work, as shown in Figure 4. The file is grasped, with the thumbs assisting the thrust of the tool away from the operator. This type of filing is for final smoothness of finish. For fitting a shaft, for turning the lathe cut lengthwise, for dressing narrow surfaces, or taking off the wire edge in tool dressing, draw-

FIGURE 8. DO NOT USE AS A HAMMER OR A SCREWDRIVER.

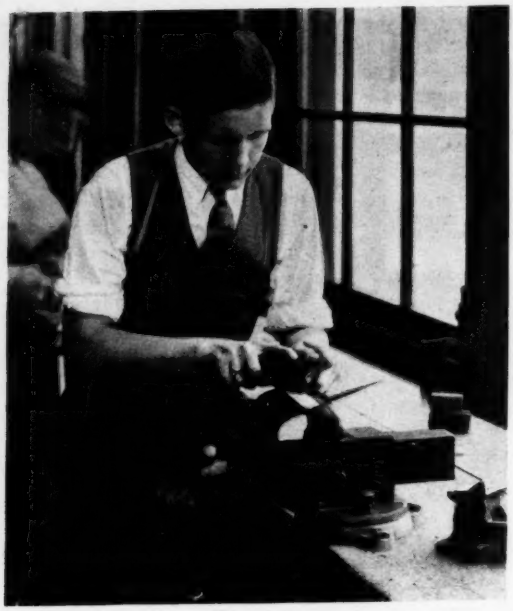


FIGURE 9. CLAMP THE WORK NOT THE FILE.

filing has its usefulness. The angle at which the file is held across the work must vary to have the teeth always present a shearing edge; otherwise the teeth will merely groove the work. A duller file can be used for drawfiling. Mill files usually are preferred.

While *lathefiling*, shown in Figure 5, is not considered a type of precise filing, it has its place and is used by many mechanics for surface finishing. It is acknowledged that lathefiling is not truly circular, as the file cannot be advanced to exactly coincide with the revolution of the work, causing more rapid removal of material at certain spots. In this type of filing, the lathe speed is changed to high and the point of the file is turned about 30° toward the headstock, to assist the file in clearing itself of chips. The importance of securely handling all files used in lathes must be stressed. Mill files due to their smoother cut are popular for lathefiling. A special lathefile is made, which, by the almost lengthwise direction of its upcut, overcomes much of the tendency of this type of filing to be "out of round."

Hand-saw filing, as pictured in Figure 6, is a good example of tool sharpening. A clearer view of the work is obtained by having the work higher than for other types of filing. The file—a 5½" slim-taper file—is held horizontally, with its point tipped toward the heel of the saw for a crosscut tooth, and straight across the blade for a rip tooth. The bottom of the saw teeth project about ¼" above the clamp edges. This is sufficient to prevent chattering. Always start a taper file cutting near its point, in order that the convexity of the entering wedge may knock off the glazed surface of the saw teeth.

FIGURE 10. DO NOT PILE WORK ON FILE.

As an example of *one-hand control* of a file note Figure 7, where a square file is being used in the cutting of a keyway. In this instance the fingers of the left hand can assist in keeping the file in contact with the groove, relieving the strain which is otherwise placed on the forefinger of the right hand. This grasp of the right hand is used in sharpening auger bits, small tools, and knife edges.

Three common *misuses* of files are illustrated in Figures 8, 9, and 10. These are using the file as a hammer, more often for prying; rubbing work of a large area on a clamped file; and burying the file under other tools, or the work.

As the surfaces of all files are oiled before packing, it is a mistake to start a new file into a cut without rubbing it on soft wood or soft cloth. However, oil is purposely applied to files for finishing close-grained, tough metals. Sometimes a mixture of chalk and oil is rubbed into the teeth in close-grained metal work, to reduce the number of pin scratches.

It is impossible to keep certain metals from filling the teeth of the file with chips, so that the *file card and brush*,

FIGURE 11. USING A FILE CARD AND BRUSH.

shown in Figure 11, is a necessary accessory. Use the wire bristles to loosen the chips, then reverse the brush and with the fibre bristles remove the filings from between the teeth. Be sure to card all files during work and before putting them away.

As file teeth are made as hard as fire and water can render the steel, the *teeth are brittle* and are easily nicked by sudden shock. The careful operator will avoid dropping a file, and, instead of throwing it into a drawer with other files and tools, will place it in a rack or a separate compartment, provided in his workbench.

In conclusion, remember that while filing is an ancient method of shaping material, it is also an exact mechanical art. Files are highly-tempered cutting tools that are not intended to replace screwdrivers, hammers, or pinchers. In ordering a file give its proper name, spacing of teeth, and length. Teach its correct use with a view of proper appreciation of a much misused, but effective tool.

CHAIRS

Herman Hjorth, Yonkers, N. Y.

THE USE of chairs dates back to the earliest civilizations. Examples of Egyptian, Greek, and Roman chairs, several thousand years old, are to be found in the great museums of the world, and, strange to say, they do not differ a great deal from the more recent types. As a matter of fact, many decorative motifs from these old chairs have been used by modern designers. During the Jacobean period, in the beginning of the seventeenth century, chairs were not very common and were used only by the nobles and people of importance, while ordinary people were content to sit on stools. Even so, the chairs were very uncomfortable, as they had only wooden seats and backs. But, in the latter part of that period, toward the end of the century, a great improvement was made in the construction of chairs, as the art of caning was introduced from India, and the art of upholstery from France. In the latter country very elaborate, beautiful, and comfortable chairs were made, especially in the "Rococco" period during the reign of Louis XV.

Chairmaking in those days was indeed a fine art, calling for the highest type of craftsmanship. The modern tendency, however, is toward more simple lines and does not, therefore, require such a high degree of craftsmanship.

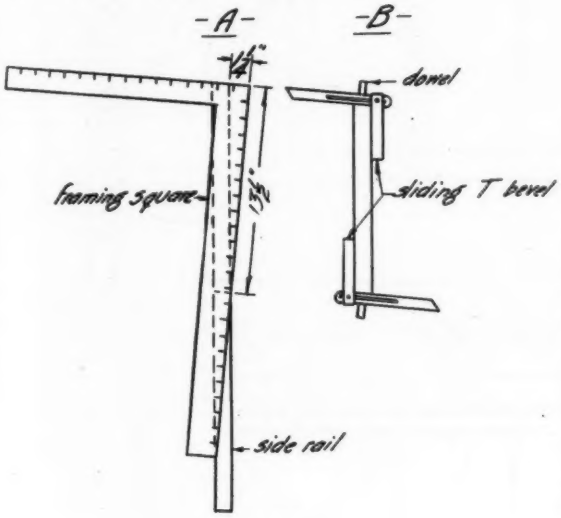


FIGURE 2.

Dining Chair

Of the chairs illustrated herewith, the dining chair, Fig. 1, is the simplest of construction. Formerly such chairs were joined with mortise-and-tenon joints, but dowels are preferred by many in modern practice, because they are easier and quicker to apply, and the construction is not weakened by cutting away too much wood.

In most chairmaking it is a good rule to follow to glue up the back and the front (rails and legs) separately, and let these two parts dry before finally assembling the chair. The construction should, therefore, be planned with this general aim in view.

Making the Working Drawing: The first thing to do is to make a full-size drawing of the side view of the chair and also of the seat and back. Templates can then be made, from which the various pieces entering into the construction of the chair are cut. The legs and rails should first be cut and shaped. It will be noticed that the ends of the front and rear rails are cut square to their sides, but that the ends of the side rails are cut at an angle, because the back of a chair is always narrower than the front. This angle can be found very easily with the aid of a framing square. (See sketch, Fig. 2.) The length of the side rail is 13½", as shown in the drawing, and the taper for each side is half the difference between the total width of the front and rear rails, or 7½" — 6¼" — 1¼". The square is placed on the edge of the rail, as shown in the sketch at A, and the angle is marked. A sliding T-bevel is now set to this angle, and the other piece is marked. (See the sketch at B.) Note that the angles are marked from opposite sides. The rails may now be grooved to receive the slip seat, and the holes for the dowels laid out and bored in both rails and legs.

Cutting the Pieces for the Back: The next thing to do is to cut the pieces for the back. The wide piece (7½") is cut and doweled into the rear legs, after which it is planed on the front side to conform to the shape of these. The thickness (⅜") is then gauged from the front side, and the rear side is planed to the gauge line, scraped, and sanded. The fretwork panel will be stronger if it is made of plywood. It is sawed out with a coping saw and may be shaped afterwards with a chisel and sandpaper. The edges may be rounded if desired. It is joined with dowels to the two other pieces, after which the whole back is fitted and glued together. When dry it is smoothed with scraper and sandpaper. Before gluing the front rail and legs, it is well to assemble the chair, and lay out and cut the recess in the front legs for the slip seat. The stretchers should be cut and fitted at this time. When the front legs and rails are glued and dry, the whole chair is glued together. When this is done it is important to measure the diagonals (i. e., from the front legs to rear legs) so as to make sure the pressure of the clamps does not twist the seat out of shape. By manipulating the clamps a little any unevenness can be corrected. When the chair is dry, corner blocks should be carefully fitted, screwed, and glued in place.

The Seat Construction: The seat is made of a frame fitting loosely in the groove cut in the rails and front legs. The allowance depends upon the thickness of the material with which it is to be covered. A piece of thin plywood is nailed to the top of the frame. Plywood is preferred to webbing, which stretches in time and causes the seat to sag. (See the sketch, Fig 3.) A pad is then made of hair or tow, sewed between two pieces of burlap, so that the stuffing cannot slide. This pad is drawn over the sharp corners of the

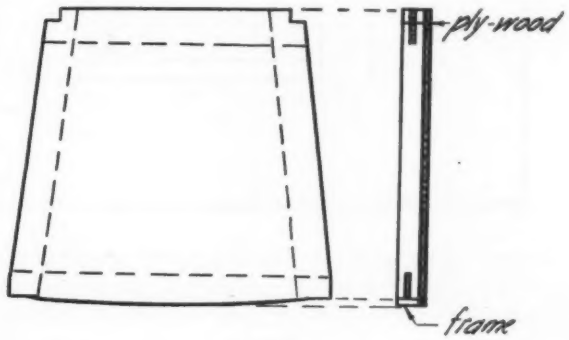


FIGURE 3.

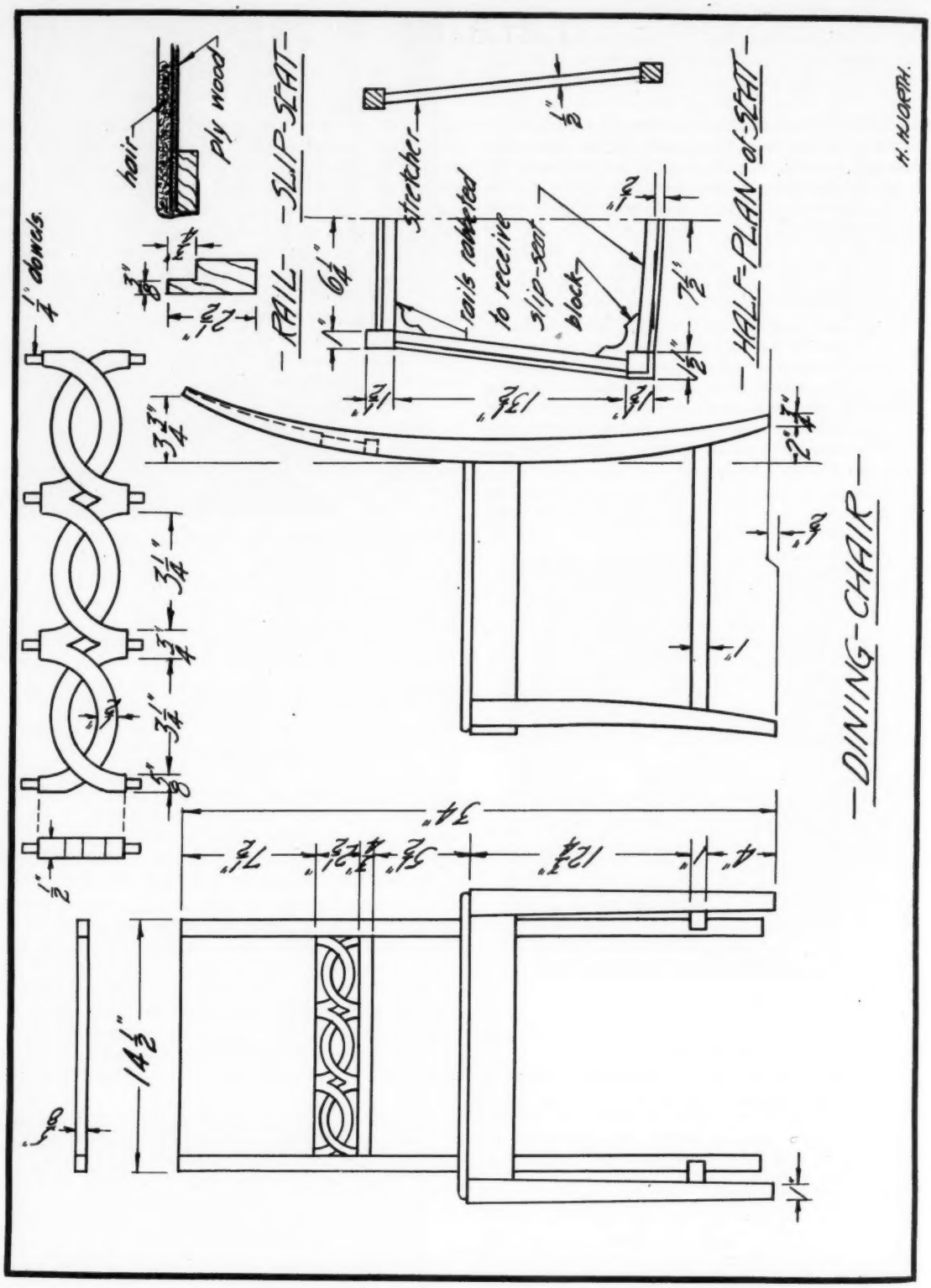


FIGURE 1.

seat and tacked all along the edges. A piece of cotton wadding is placed on top of this, and the whole is covered with muslin, drawn tightly over it and tacked to the underside of the frame. The seat is now ready for the covering, which is tacked to the underside of the frame.

Another Dining Chair

The dining chair in Fig. 4, is constructed in the same manner as the chair in Fig. 1. The front legs are of the cabriole type, characteristic of the Queen Anne period. A piece of lumber, 2½"x3½"x17¾", is needed for each front leg. The shape of the cabriole leg should be laid out from a tem-

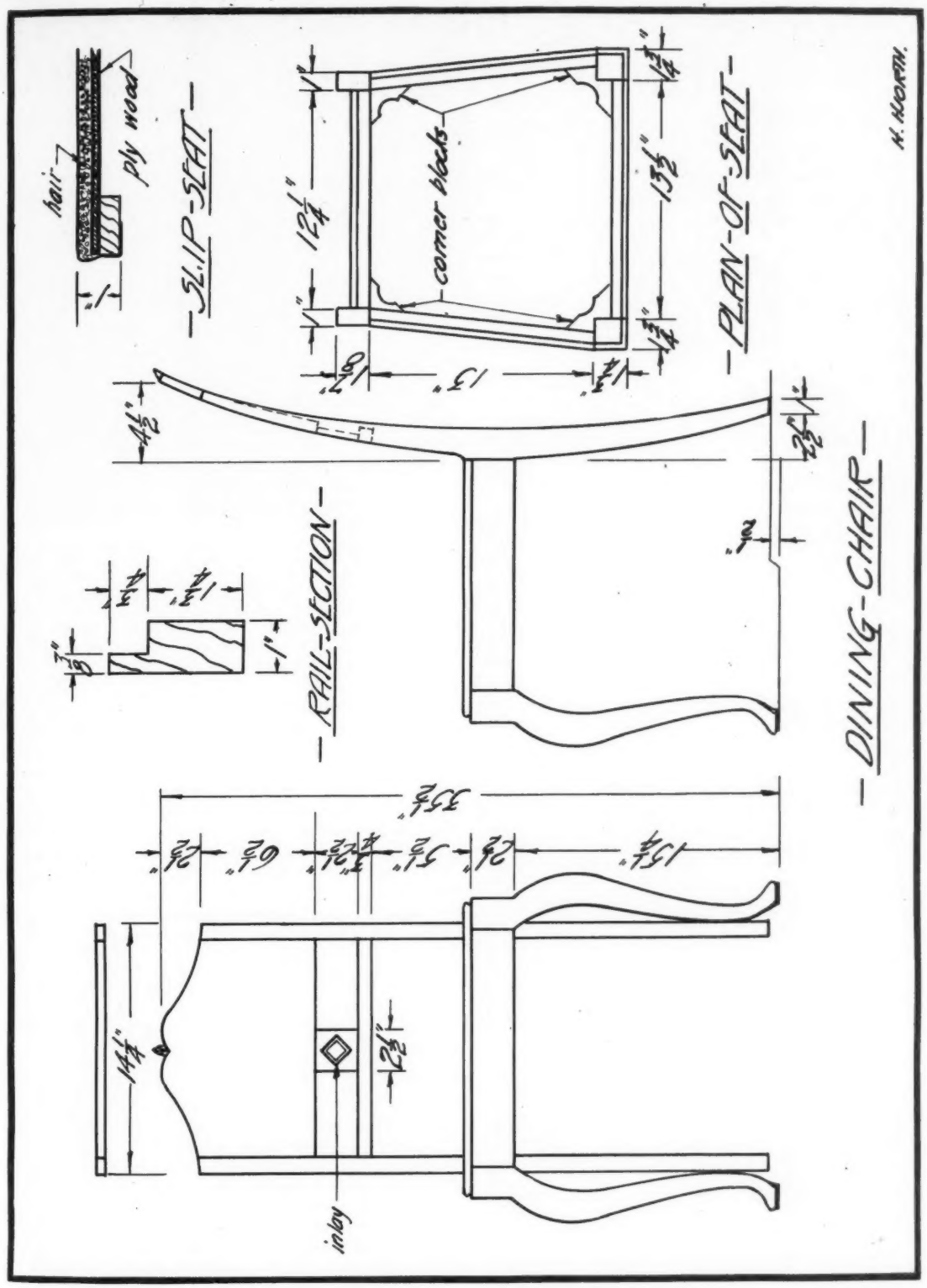


FIGURE 4.

plate on these pieces, after which they are sawed out on a band saw. The waste pieces resulting from the cuts on the first side should not be entirely separated from the leg proper until the saw cuts from the second side have been made. It is necessary to retain the waste pieces in order to keep the lines marked on the second side, and have the leg lie flat on the band saw while the cuts from the second side are being made. These legs are smoothed by hand with spokeshave, scrapers, and sandpaper.

(To be Concluded in June.)

MODERN LACQUER MATERIALS AND THEIR APPLICATION

Ralph G. Waring, The Tuscarora Laboratories, Syracuse, N. Y.

While there are still numbers of people, in the lacquer industry and elsewhere, who believe that lacquers are but a new fad, recent governmental data shows a present production of ten million gallons of lacquer per year, as compared with one million gallons in 1920. Certain it is, that the newest infant in the "Save the Surface" industries has had a most phenomenal growth, and in many ways has upset the theories and pet notions of many plant chemists and superintendents. From a laboratory dream, brushing lacquer has become a household word throughout the land.

So many erroneous conceptions appear to be prevalent among schoolmen as to what "lacquer" is or is not; what it can or cannot be used for, that I have made an attempt to present this highly technical subject in simple layman's language. My own work with lacquer covers a number of years and the photographic data shown is the result of careful experimentation and observation in my laboratory.

A salesman of a large stain manufacturer recently came to me for information on paint matters and during the conversation showed me a letter from his salesmanager in which appeared the statement that "the new lacquers now out are all bunk. Lacquer was made by the Chinese thousands of years ago." The letter quoted from an encyclopedia to prove the assertions. If a salesmanager of a paint and varnish firm can so misinform his roadmen, what then must be the ideas of the average teacher and household "handy man"?

Briefly, the difference between Chinese lacquer, varnish, and modern lacquers is this: Chinese lacquer and varnish *dry* for a very brief period of time through the loss of the thinning material (turpentine, etc.). From then on a purely chemical action takes place, whereby the film changes from a liquid to a solid, and actually gains in weight over a period of months or even years.

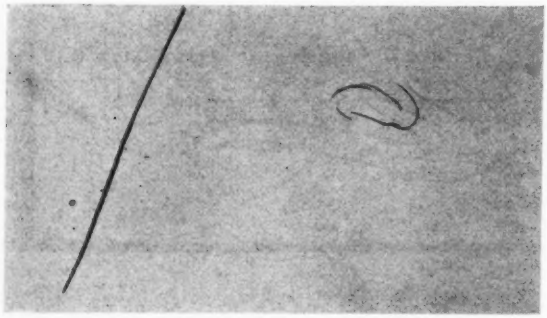


FIGURE 1. A seven months' failure of pigmented lacquer applied over a high grade "oil enamel" in perfect condition for refinishing with the same type of materials. The checks or ruptures are generally short, irregular, seldom straight, not bold, sometimes curved and shallow. Application of the same lacquer to raw wood portion is perfect after two years.

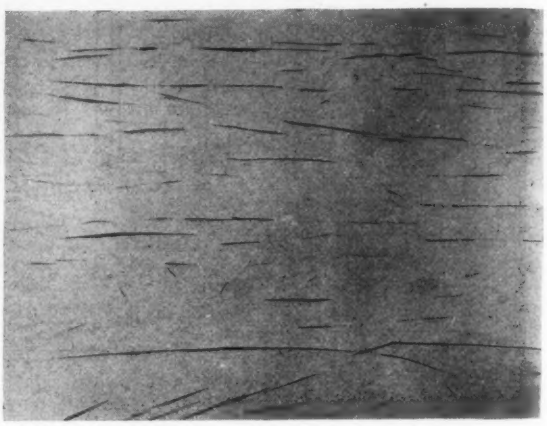


FIGURE 2. An eleven months' failure of pigmented lacquer over old "gloss white" in good condition for refinishing in enamel. The ruptures are generally long, regular, and generally straight sweeping lines, fairly bold, sometimes with angular offshot, shallow. The same material applied to the raw wood portion of this furniture is perfect after three and a half years.

The modern lacquer dries through the loss of the thinners alone and the change is a physical process only, occurring during a matter of a few hours at the most.

In the case of Chinese lacquer and varnish, the ultimate chemical action results in the destruction of the film, since it is no longer flexible when its oxidation is complete, and cracking and loss of luster result. On the other hand, a properly designed and applied lacquer, *on correct foundations,* has an indeterminate life, and increases in durability and toughness with age.

With these fundamentals in mind, therefore, let us make a brief study of the constituents of lacquer.

The Constituents of Lacquer

The first and most critical element is the *cotton,* which is received from three principal sources:

(1-2) Long-fibre cotton and tissue paper (both used in fine-metal lacquers).

(3) Linters or short-fibre cotton, left on cotton seed after the long fibre has been removed in the cotton gin.

The linters have considerable dirt and foreign materials mixed with fibre, which is put through a most strenuous process of boiling at 80 lbs. pressure in a solution of caustic soda, bleaching with chloride of lime, washing, and drying. The now purified cotton linters are put into *nitrators,* which are chemical apparatus of the closed type, with pressure and temperature control within very accurate limits. Here the linters are subjected to the combined action of mixed sulphuric and nitric acids, generally about 32 pounds of cotton for 1,600 pounds of mixed acids. The acids are under extreme technical control, for nitrogen content and temperature between 35°-55° C. From fifteen minutes to an hour is required for nitration or the processes by which cotton is changed from pure cellulose to cellulose nitrate. Further washing, boiling, bleaching, and drying are employed until the linters are satisfactory for the purpose intended.

FIGURE 3. A three months' failure of white pigmented lacquer enamel over sanded cheap, gloss-varnish. The ruptures are very deep, short, straight or short curved, and very wide in the center. Spots occur where any of the cheap varnish remained on the chair. Portions of chair sanded to clear the wood before lacquering are in fine shape after two years.

In order to remove the last trace of water, the pure cellulose nitrate (pyroxalin) is mixed with denatured alcohol, subjected to 300 pounds pressure, and dried to an alcohol content of 30 per cent. In this form it is stored and shipped, since dry pyroxylin is very dangerous. With the alcohol, it is classed by the Interstate Commerce Commission as an inflammable liquid. Since alcohol enters into many lacquer formulae, the 30 per cent alcohol content of the pyroxylin is not objectionable.

The nitrogen content of the finished batch of pyroxylin is, however, very important, for it is this factor which determines its use. For instance, pyroxylin having a nitrogen content of 11.2 per cent to 11.7 per cent is used for photograph films, silk textiles, etc.; that having a range of 11.8 per cent to 12.4 per cent nitrogen (the A. S. pyroxylin of either one-half second or 20 seconds viscosity) is principally used in making lacquers; while the 12.5 per cent to 13.5 per cent group is used for making smokeless powders and explosives. Since the last mentioned material dissolves in but one solvent, acetone, it cannot be used in making lacquers, and hence the statement that guncotton (13.5 per cent N.) is used in making lacquers, is rather ridiculous but is frequently uttered by the misinformed.

The Solvents

The next important constituent of lacquer is the group of materials known as "solvents," which are rather complex both in their chemical structure as well as physical behavior. Chemically speaking, they are the chief carrier for the pyroxylin (the term which will be applied to nitrated cotton hereafter).

I. Physically the solvents are divided into:

A. Low Boilers.....having a distillation range of 70°-100° C.
B. Medium Boilers...having a distillation range of 115°-145° C.
C. High Boilers.....having a distillation range of 150°-200° C.

Ethyl acetate, which distills at 70°-80° C., may be mentioned as a class A (low-boiling) solvent; Butanol (normal butyl alcohol) distills at 114°-117° and is a medium boiler; while Ethyl lactate distills at 150° and is a "high boiler."

This boiling range is one of the most important technical features in the manufacture of lacquer since, by the mixing of different solvents and their manipulation, a fast, medium, or slow setting lacquer can be produced. Furthermore, through their use the matters of "flow," "gloss," freedom from "blush," and other technical advantages are more easily controlled.

II. Chemically, the solvents are divided into:

1. Esters, the most important group, to which belongs amyl acetate and propriante.

3. Ethers (with alcohols) form the important metal lacquer solvents.

2. Ketones, as methyl-ethyl and methyl-propyl.

4. Comparatively inodorous materials, such as di-ethyl carbonate, used in making the enamels for refrigerators and closets.

Nonsolvents

Next, we must consider the nonsolvent groups of materials used in lacquer manufacture. These include denatured alcohols, benzol, and the less toxic tolnol, which are used to dilute the mass of dissolved lacquer as far as possible without affecting the properties of the real solvents in their ability to retain the pyroxylin in solution. It is through the use of nonsolvents that it is possible to reduce the cost of modern lacquers to reasonable limits. These materials, to a lesser extent also exert a solvent action on the other constituents of the lacquers, as well as aid in the control of *blushing*, turning white or gray.

The Plastic Elements

Up to this point we have considered no provision in the formulation of lacquer for rendering the film of the dried lacquer flexible or long lived. It happens that even with great care in manufacturing and blending different batches of pyroxylins, some of the nitrogen compounds formed are unstable and tend to produce an acid condition which is very undesirable and hence must be provided against. For this purpose di-ethyl carbonate (diatol) is used with increasing frequency, although cellulose acetate can be, and is, used as well.

Furthermore, the lacquer film needs some softening, and for this purpose the mainstay in the past has been a nonevaporative material, like castor oil. More recent practice has overcome the poor adhesive properties of a castor-oil film by substituting partially processed linseed oil, like Kellogg's White Diamond K. Great care must be exercised at this point in formulation, since too much oil means a slow-drying, or even "soggy" film. Again, by the use of plasticisers (flexibility agents) such as tricresyl-phosphate, we can produce a film of great longevity, in addition to decreasing its inflammability. By using instead, however, a material like di-butyl phthalate we are enabled to overcome blushing (turning white) and cause a blending of the pyroxylin and the gums, which are classed with the oils as film forming materials in the manufacture of lacquer. Of these materials "wax-free shellac" and "wax-free Dammar gum" are probably the most important. Lately, however, it has been found that remarkable waterproofing properties are built into the lacquer through the use of glycero-ester (rosin glycerine) gums in solution. To a lesser extent some of the alcohol soluble copal gums are being used in an effort to produce lacquers approximating varnish in thickness of film and pore leveling properties.

Lastly, two waxlike materials are of considerable new importance: Butyl-stearate, which helps to produce a film of remarkable durability; and aluminum stearate, which has the property of "flatting" the gloss to an extent, that it appears to have been rubbed dull.

To summarize them, we find that:

1. The pyroxylin (cellulose nitrate) produces waterproofness; resistance to printing, hardness, and durability.

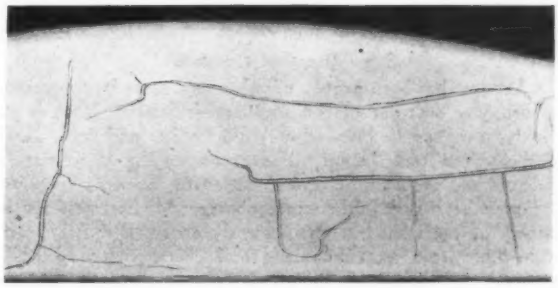


FIGURE 4. Failure, after seven months, of pigmented lacquer over "enamel undercoater." Ruptures are not frequent, rather bold, long, sweeping, and somewhat irregular knife-like cuts, starting and ending shallow, deep in center portions, sometimes parallel. Portions of this chair lacquered on raw wood are perfect.

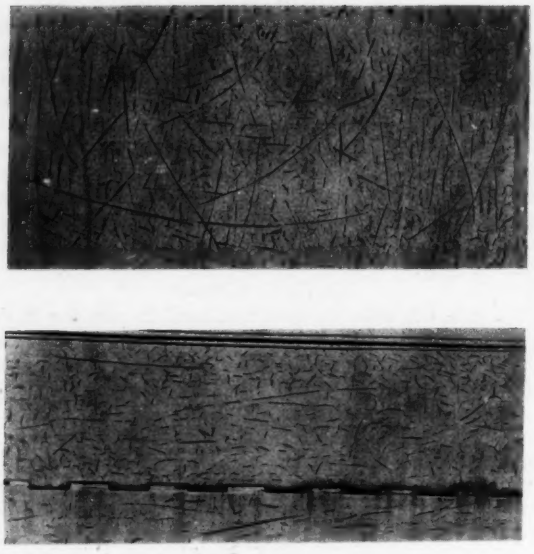


FIGURE 5. Failure of brushing lacquer, after three months, over a water sanded maroon auto enamel in good mechanical condition. This was a fine job when freshly lacquered. The ruptures are very numerous, generally short, sometimes curved, deep, and very irregular. Complete destruction of varnish is evidenced, necessitating refinishing from metal primer to finish coat.

2. *Solvents* and *nonsolvents* dissolve the pyroxylin and resins, increase the gloss; the nonsolvents especially give dilution and freedom from blushing.

3. *Gums* and *resins* build up the film and aid in the adhesion of the pyroxylin.

4. *Softeners* and *plasticisers* offset the brittleness of the gums and resins; may increase the durability and fireproofness of the film; help to maintain the properties of the pyroxylin and gums through blending; and in the case of processed linseed oil increase the adhesiveness of the dried lacquer.

Pigments in Lacquers

These factors all apply to the clear lacquers, both brushing and spraying. Strange as it may seem, the addition of pigment brings into the manufacture of lacquer an entirely new factor, that of protection of the lacquer itself by the pigment, against the destructive power of the actinic rays of the sun. Hence, it is desirable that the pigments employed have great opacity (hiding power). They must also be manipulated in processing so as to prevent settling and hardening in the can. I lately examined a gray lacquer from which the black had settled out in flintlike pyramids, about $\frac{3}{16}$" high, which almost defied crushing again. The pigments should also be of such a type that the coloring matter shall not be dissolved out by the lacquer thinners, thereby producing a condition, still occasionally met, known as "bleeding."

Now that we have made a brief study of the lacquer materials, let us consider some of the practical problems which arise through the application of materials purchased on the open market for experimental testing.

Some Practical Cautions

Lacquer has been grossly misadvertised as to its properties for brushing over old enamel and varnish finishes. True it is, that lacquers can be brushed over old finishes and really look good for the time being. The accompanying photographs illustrate the products of several nationally known companies and may be called fairly representative. My research for a number of years has brought home the fact that it is impractical—both from an engineering and chemical standpoint—to mix two systems of finishing so radically opposed in their fundamentals as varnish and lacquer. Hence, when the claim was made in advertisements that lacquer could be brushed over varnish, I immediately started check experiments, for I have learned never to take any manufacturer's statement regarding the properties of a product, until I have made a laboratory check. Please note that these tests were made, not on small laboratory test panels, but on furniture and other articles in daily use. It is only in this type of experiment, under daily observation, that the influence of the "human element" which often changes the findings of laboratory experiments, can be obtained and actual results can be checked.

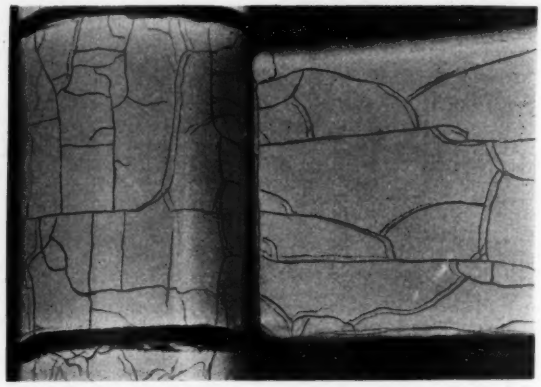


FIGURE 6. A seven months' failure of pigmented lacquer over a two-year-old floor varnish. Numerous ruptures square and oblong network; often double-lined in parallel; very narrow type. The same material applied to the clean wood on this chair is in good mechanical condition after two years.

The caption under each photograph notes the material over which the lacquer was applied, the type of failure which resulted, and the time required for the breaking down of the finish. Especial note should be made of the fact that in each case, where the lacquer was applied to raw wood, durability has proven satisfactory.

In the case of the Buick car, the two-year-old maroon enamel was water sanded and spot-putty glazed. It was in fine condition for an oil-enamel finish. When, however, a lacquer enamel was used, complete destruction of that film resulted. The car was finished June 20 and complete failure of the lacquer was noted September 1. It will be necessary to strip the finish to the raw metal and rebuild.

Brushes to Use

Some practical pointers in the application of brushing lacquers may be mentioned at this time. First, in the matter of brushes, it will be found that a good quality Fitch or medium soft bristle is best; next comes the high-grade medium-soft bristle type of black China bristle brush made specially for lacquer. The usual black China bristle is not good, as it is too stiff.

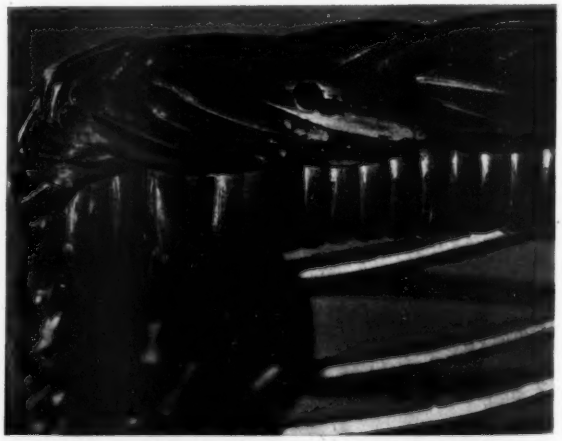


FIGURE 7. Failure after three months of brushing walnut lacquer over gloss varnish on willow furniture. Destruction of varnish denoting total lack of adhesion.

Drying Qualities and Dangers

Furthermore, little or no attention can be paid to the statement that the lacquer "dries in thirty minutes." If *any* of the brushing lacquers now on the market (and I have tested seven brands) is applied over a previous coat, in less than two or three hours, the worker will certainly find himself in a lot of trouble, through the fact that the new coat will quickly pick up and dissolve the first.

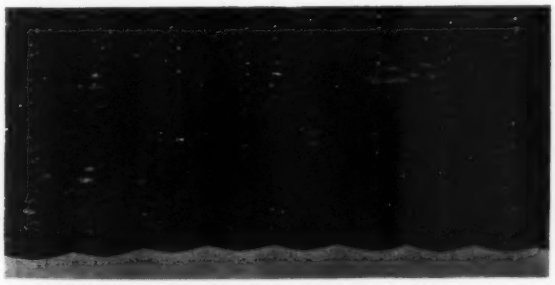
Lastly, a floor covered with lacquer must not be used without allowing it to dry over night. It will really be worth something then. Floors to be refinished in brushing lacquers must be stripped with alkali or caustic, neutralized with vinegar, and dried. Floors treated with varnish remover retain enough wax in the pores and joints to prevent the lacquer drying for a long time. One half of a test floor was treated with strong "gold-dust" solution to remove the old finish, cleaned, washed with vinegar, and dried. The other half was cleaned with varnish remover. Both parts were dried over night and lacquered the next morning. The first half set hard in an hour; the part cleaned with varnish remover took twelve days to dry ready for the second coat. This second coat required three days to dry as against three hours for drying for the alkali treated portion. Furthermore, the portion cleaned with remover did not have half as much gloss as the alkali portion. Technical examination showed that the lacquer thinners dissolved the traces of paraffin wax on the floor and mixed with the film. Since wax of this type destroys many of the properties of a lacquer film, it is readily understood why the floor lacquer dried so slowly.

Sanding and Polishing

In the matter of sanding lacquers, it is well to apply two or three coats, three hours apart, without any sanding. Dry the last coat over night and then sand it to a glasslike surface by using 8/0 or 10/0 "wet or dry" sandpaper and *gasoline*. This is by far the best method I have used and is original. It cuts the lacquer fast, level, and is clean. I have used soap solution, water, and oil, but these are too slow and dirty to be practical. Sand in one direction only, after tearing the paper in eighth sheet size.

Last of all, the lacquer can be polished by using the following:

Crude oil, 5 oz.	Butter of antimony, ½ oz.
Vinegar, 2 oz.	Oil of citronella, ½ oz.
Denatured alcohol, 3 oz.	Water, 5 oz.



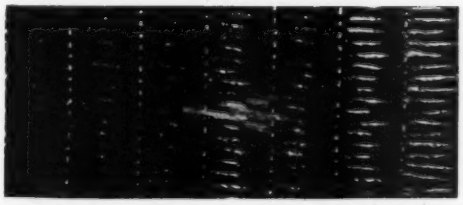


FIGURE 8. Failure after thirty-three days of walnut brushing lacquer of fibre furniture with an "eggshell varnish" finish. There is a lack of adhesion of the finish to the fiber. The lacquer has completely destroyed the usual properties of the finishing coat, with the result that it is brittle, easily bumped off with the heels or by contact with other chairs.

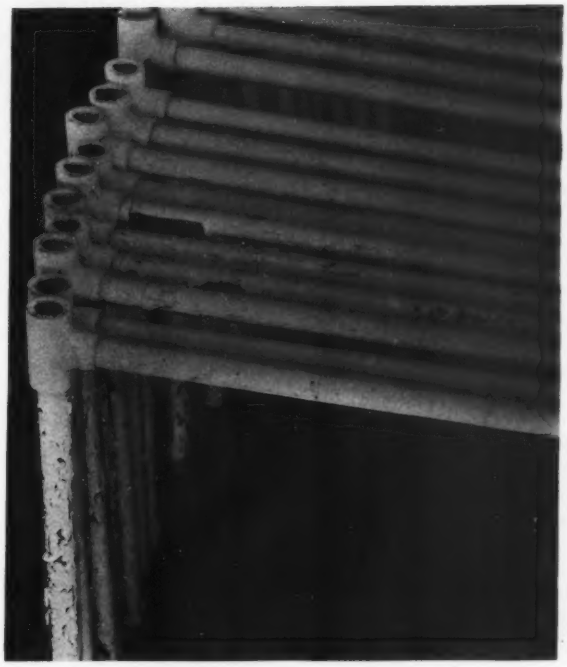


FIGURE 9. Failure after four days of a high grade "white ground" surfacer of the lacquer type made by a reputable manufacturer. This was applied with a De Vilbiss Aeron, after varying reductions, to the frames which had been cleaned in a boiling solution of 55% trisodium phosphate, 35% sodium carbonate, and 10% sodium hydroxide. The failure was caused by too much pigment and too little pyroxylin solution (lacquer) binder. Perfect results were obtained when "opaque ground" and "white enamel" lacquer 50-50 were sprayed on several check frames as indicated at the top of the picture. Failure was not due to traces of oil or grease remaining on the frames before lacquering.

Add one cup of rottenstone and shake well. Make up a pad of cotton flannel or heavy soft cloth, apply the polish freely, and use with plenty of "elbow grease" by rubbing heavily in straight lines. This will polish up full and bright, with a dry, soft, and clean cloth, and will leave a surface free from any trace of oil or bloom.

Lacquers undoubtedly are wonderful materials, but they must be used within their proper limits. It is well not to believe all the advertisements say or there will be heartaches.

Fundamentally, do this: *Build up a lacquer finish on shellac or raw wood only. Do not mix a varnish system of finish with a lacquer system. That is asking for trouble.*

Last of all, many varnishes today equal in durability and resistance to wear, some of the nationally advertised brushing lacquers. In the final analysis the only advantage the latter possesses is speed. Spraying lacquers on the other hand, possess many properties not yet discovered in brushing lacquers.

ART EDUCATION

The psychology of art is an inquiry into the mental processes by which we perceive and produce and appreciate works of art. When we are feeling comfortable in a warm room looking out at a storm, we are glad we are not in it, for we then think only of the disagreeable side. When we are actually struggling along in a storm the experience does not seem disagreeable—the struggle seems less severe than when looking on—and we actually enjoy the exhilaration. So this new art movement seems formidable in its outlook but in buffeting with line, form and color, you will not find it so difficult as you had expected.—Dr. Gustave Straubenmüller, New York City.

INDUSTRIAL-ARTS MAGAZINE

E. J. Lake S. J. Vaughn
Editors

FAITH RENEWED

There is so much pessimistic reference to the youth of our time, that the expressed faith of one who has had unusual opportunity for the observation of young people of the *favored* class who go to college is encouraging.

At the close of twenty-five years of excellent service as dean of men at the University of Illinois, Thomas Arkle Clark makes the following comments:

"I have learned a great many things about young people, especially, during these 25 years and I hope I am not through learning.

"They are very shrewd, these young people of ours. They see through you very clearly, very accurately. They are usually very just and very reasonable when you take them as individuals. They can detect with amazing certainty, insincerity, and hypocrisy. If you are fair and square with them they'll be for you, no matter how severe you are.

"It is pretty completely a waste of time—yours and theirs—to give them advice unless they ask for it. The skillful man will enveigle them into asking.

"There is far more good than bad in them—even in the worst of them. I once did not think this, for I took the young person at his own estimate, and that is a procedure seldom wise. There is nothing that the present-day young person so much dislikes as being laughed at; there is nothing that so gripes him as being thought unsophisticated.

"So he broadcasts his irregularities; but he is a lot better than he says he is and in general better than his father was, though he doesn't want you to think so. He isn't any shrewder than his father was. He has thought out very few new excuses; he pulls no new tricks; he just has a more balanced mind and he's more moral. If he's lazy, as he often is, it's the fault of his parents.

"You can do anything with him if you'll take the time, and have the patience to understand him and the genius to show him you have a personal interest in him.

"I have come to have in these 25 years more and more faith in the young person. Under the thin veneer of his cynicism and sophistication there is a genuineness and a sincerity and a seriousness upon which I feel sure we can depend. The young person of today is not going to take lightly the tasks of tomorrow."

VOCATIONAL GUIDANCE

Investigation of the impressions of those interested in vocational guidance as to the best procedure in this difficult obligation is being carried on by Professor Frederick J. Adams, of the University of Texas, who is completing the requirements of his doctor's degree at the University of California.

The questions are being sent to 377 vocational-guidance leaders, vocational-education leaders, and professors of education. It would seem that this is a beginning only of the gathering of opinion on which guidance might be based.

Important questions of the list bear on direct versus indirect influence in guidance. Should the pupil be influenced to the point of actual selection of a particular occupation, or should the influence be exerted to serve only as incentive toward the development of recognized aptitudes for a type or class of occupations? Of course the school that invites a definite choice of occupation should be ready and able to train for that occupation.

If opinion was solicited from a wide range of authority in education there can be little doubt that vocational guidance would be concerned most with the incentive toward the development of recognized aptitudes and would be less concerned with training for specific vocation.

Few teachers acquainted with large numbers of pupils and concerned with their direct preparation for lifework take the self-selection of pupils seriously; but on the other hand few teachers of experience undervalue that incentive which a definite selection gives.

One great difficulty of education as it is now carried on by the schools is the purposeless attitude of pupils toward their schoolwork. They become expert in "getting by" with a prescribed routine of school exercises in the blind faith that "getting by" is adequate.

Even where faith is established in themselves, it is often devoid of other incentive than to do and appear well with their teachers and their parents.

The greater incentive of self-development for a particular, chosen occupation, is altogether desirable when the schools can support this incentive by adequate instruction and training.

THE ARTS IN SCHOOL

For many years the graphical arts have been given more attention in the public schools than music. There is evidence that instruction in music is increasing rapidly however, and with the distinct advantage that it enriches the school activities and school life through the organization of bands, orchestras, and choruses.

While the opportunity for organized effort is peculiar to the musical and dramatic arts, the graphical-art teacher is not without advantage of a similar sort in the competitions for illustration of school interests. An active and able art director will see to it that the schoolrooms and grounds reflect the concern of those of her disciples who aspire to art production.

The idea that a graphical delight must be a solo, rather that a cooperative production, does not apply to school art. Soloists are somewhat of an abomination in school life, whether in athletics, or aesthetics.

The sorry reflection persists that in spite of our remarkable gift for organization and our pronounced admiration of team work, we find ourselves basking pridefully in the light of a great soloist.

Hero worship should not become a democratic pastime. It has been often and much emphasized that "lives of great men oft remind us we can make our lives sublime" but hero worship can be overdone, especially when the hero performs his stunt as representing a large group and relieves the ninety and nine of any obligation but applause.

The schools are less concerned with the discovery of infant prodigies than with the development of a general high average of competence.

IMPRESSING EFFECTS

Not the least of the industrial-arts teacher's obligations is to make superior effects so vivid to pupils that standards of effect are established. The effects that pertain to the industrial arts are so varied that they must be carefully classified under purpose and style, and must be studied and impressed under accepted and understood conditions.

Teachers of art have not found a better way of impressing effects than through the definite experience of execution in some least difficult medium. Drawing, painting, and modeling will persist as the most certain way of learning in art.

To learn to see we must do a lot of seeing, and we must do it under the exacting standards of good example.

Good music may now be presented to classes in the rural as well as the metropolitan school. Good art may be illustrated before pupils who may never hope to see the originals. Such demonstrations are essential to the development of stand-

ards but good music and art need interpretation and impression beyond casual presentation.

Copying as a means of impression is not to be condemned as plagiarism. The best way to study composition is to trace the diagram of a variety of compositions, and determine the relation between the pattern and the effect in various cases.

A most impressive exercise in the impression of landscape is the recognition of interests in nature similar to those presented by the artist in his picture. The layman's life may never be enriched by art until impressions carry over into experience.

WE TAKE ISSUE

The lack of faith in the study of art as conducive to mental development is not uncommonly charged against the educated of our time but it is not usual to find a definite opinion expressed by scholarly people on this interesting issue.

The report of a committee of college educators appointed to investigate the educational organization and processes of their college concluded their report on the art instruction offered with this significant statement:

"The student with genuine mental ability but without an aptitude for the subject may flounder in spite of the most conscientious work, where a student with very little mental ability but with some aptitude in sketching may do very well."

This committee commended the organization and processes of the instruction in art under investigation and offered this final opinion in reference to art instruction without disparagement of the particular work under consideration.

It may be assumed, therefore, that this college committee believes that mental ability conscientiously applied to art study will not be successful, in comparison with low mentality and some aptitude in sketching.

Mental ability is subject to a variable standard with artistic ability, but we have held fondly to the conception that art is only possible under a fine coordination of mental and physical qualities. Mere aptitude in sketching is no more a measure of accomplishment in the fine arts than dexterity is a measure of accomplishment in science.

A fine work of art is a great mental accomplishment which requires the intensive application of keen mental faculties and the coordination of physical dexterity with mental conception.

THE SHOP CORNER IN THE SCHOOL PAPER

School papers which reach the office of the INDUSTRIAL-ARTS MAGAZINE rarely give much space to the work of the school shops. The teachers of woodwork, printing, and machine-shop practice seem to feel that they are unable to write with the skill which the teachers of academic subjects possess, and perhaps that is one reason why shop news is not more frequent in the school papers.

Still the shop has more opportunities for general news than any other department of the school. The shops are constantly making interesting things which can be written about and which can be illustrated. The boys who leave the shop classes go into the employments and news about their success can be made a real factor in vocational guidance and a real incentive for good work in the shop classes.

The shop teacher who is really alive to his opportunities will make constant use of the school paper as a means of *selling* his department to the school and of establishing its educational values.

EDUCATIONAL ENGINEERS

Laurence Parker, Kansas State Teachers College, Pittsburg, Kansas

A few years ago I had an opportunity to visit a manufacturing plant which had closed down. I saw some of the very finest of automatic machinery tooled up to turn out the parts for a speedometer.

In the stock room I was shown ten thousand completed speedometers and I saw the parts for many thousands more. It was claimed that there was material on hand in that plant for a hundred thousand sets of parts. It was expensive material, too.

Assistant Community Engineers are not always on the job. We have gone into communities in Kansas to help organize evening classes and found that the manual training teacher was in touch with only a very small group of folks and those were interested in his hobby. The same thing is true in other states. We have found that the home economics teacher did not belong to any woman's club of the town and did not know any of the town women except at the place where she boarded. They were far from being community engineers and they could not know much about the demands upon them to train boys and girls into the life of their community.

The plant was closed down because in that store room was every single speedometer that the plant had ever made. They were all there because the manufacturers of automobiles did not like some of the features of that speedometer and had refused to buy them. As a consequence the company had gone out of business, the plant was being dismantled, and the parts and speedometers were to be sold for junk. All of this was because some one, who should have been in touch with the consumer of the product, had "fallen down" on the job.

Now we as teachers in a public school system are turning out a product, boys and girls, who must be absorbed to a large extent right here in the home town. There is no getting away from it; here in the home town most of them are going to work, and it is for this consumer's market that we as teachers are paid for training these folks. If we do not take any better observations of the market for our product than the speedometer company did, we shall surely reach the point some day where our manufacturing plant will either be devoted to other things or it will be run by a different set of managers.

Mr. L. H. Petit, superintendent of schools of Chanute, Kansas, is of the opinion that the superintendent of schools must be a community engineer, who watches the demand for his product and sees to it that the boys and girls are turned out in accordance with the demands of the consumer public. He is right, for that is an important part of his duties. A superintendent, though, cannot do this without the help of each one of you, his teachers, who become in fact *assistant community engineers.*

Those of you who read educational magazines no doubt realize this and are keeping in touch with your town and its activities. You know just what are the occupations of the community and what the boys and girls must know in order to be employable at good wages. You strive to shape your instruction so the boys and girls will be worth more in their home town.

In addition, let's build a highway which leads to immediate and successful participation in the affairs of life. Let's pave it with a thick base of fundamental principles underlying successful endeavor. Let's pave it with the bricks of practical application of these principles laid in place by those who have had practical experience in their use.

With the two highways open to traffic, the highway to the college should not be congested and the old rutty detours leading to blind-alley jobs may be closed to all traffic. No longer will the boy and girl with real stuff in them have a right to say, "I cannot go to college and the high school has nothing that will help me to get and hold a job."

If only mankind would remember that primarily demand, and not limitation of supply, is that which attaches value to things, and that abundance is what man wants and never scarcity, what an element of tragedy would be eliminated from human life.—*Strachey.*

WILLOW BIRD HOUSES

George E. Berger, Oshkosh, Wisconsin

Spring is at hand. We are looking forward to a means of betterment of the homes of our feather-clad friends. We endeavor to beautify their homes and environment. To do this we must continually improve and beautify the houses which we build for them.

In an endeavor to get a bird house which more exactly matches the natural environment of our birds, and is at once different from the common types of houses, I have by chance discovered the beauty of these willow houses. There is nothing to make them artificial in structure; they are purely a natural product, and are made from material taken from the birds' environment.

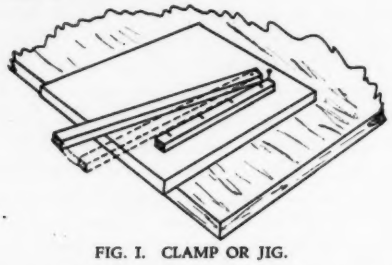


FIG. I. CLAMP OR JIG.

The material used in building these houses are the red-willow slashings, which are found in marshes, or in small patches or other large woodland areas, where the sportsman goes to hunt. As a means of fastening the small sticks together a No. 20 gauge copper or brass wire may be used. It is desirable to use this kind of wire, for it will not rust as does the common steel wire. It is more flexible and easier to handle.

The method of constructing these rustic houses is new and different from the construction of other types of houses made from twigs or willows. These rustic houses are made entirely of willows held in place by wires. The wires pass directly through the diameters of the willows. The height at which the wires pass through the willows depends upon the location of the opening or entrance of the house.

Preparation

Willows should be selected several weeks before they are to be used, so that they may become thoroughly dry. In the drying process the willows will shrink in diameter; the amount of shrinkage depends, of course, on the time of year. If the houses are made from the freshly-cut willows, cracks will appear in the houses after they have stood about the shop several weeks. The willows can be dried at the ordinary room temperature. To hasten drying they may be cut to the appropriate lengths needed. It is very desirable to select straight willows—a neat appearing house will be the result. Another item may be added here, namely, that of changing the color of the willows. Naturally willows are a bright red and may be kept so if desired. In case a change in color is desired, they can be made to take a rich, dark brown. This may be accomplished by subjecting them to heat. They may be heated over a register or in an oven. They must be carefully watched while under this treatment. If heated too much the bark is likely to peel off. The heat treatment accomplishes the drying process together with the changing of color.

Procedure

After the willows are carefully selected and dried, they are cut to meet the length of the house to be built. In cutting a chisel or pocketknife should be used. A saw is more likely to injure the bark.

FIG II.

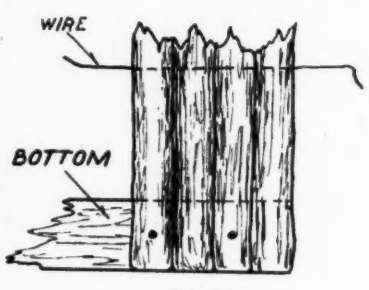


FIG. III.

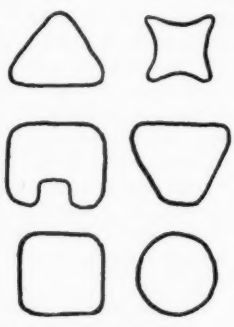


FIG. IV. PATTERN FOR BOTTOMS.

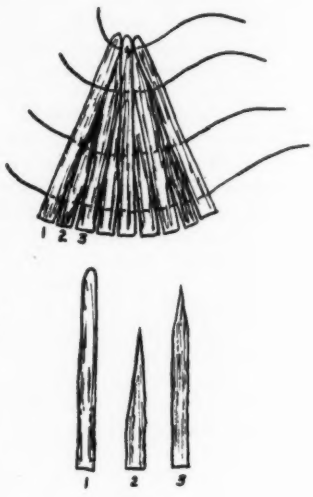


FIG. V.

The next process is boring the holes. A $\frac{3}{64}$" drill may be used. Holes may be bored with a hand drill, or better still, with a drill press. If holes are bored by hand an apparatus, which greatly facilitates boring, may easily be set up. Fig. I.

This apparatus acts as a clamp which keeps the willow from turning. It may be gauged or marked to show the distance between each hole. Marks can be placed on one of the rails which hold the willow. As soon as the willows are drilled they may be strung on wires and the exact number added to meet the desired dimensions of the bird house. It is difficult sometimes, because of the varied sizes of willows, to determine the right dimensions for the size of the house. In this case the bottom may need trimming in order to make a snug fit.

The bottom may be made of $\frac{3}{4}$" pine, or any other soft wood. In making a square house the bottom should be rounded slightly on the corners. This allows the willows to fit more closely. When they are fitted around the bottom, the next operation before fastening the bottom, is the cutting of the hole for the entrance to the house. The hole is cut with a pocketknife. If the wren is to be the landlord, the opening should be of the size of a quarter dollar or $\frac{7}{8}$" in diameter. If the bluebird is to be its occupant, the hole must be made larger—$1\frac{1}{2}$" is sufficient. It is important to make the entrance of the proper size and height. If the opening in the wren house is too large, the English sparrow is likely to make his home therein.

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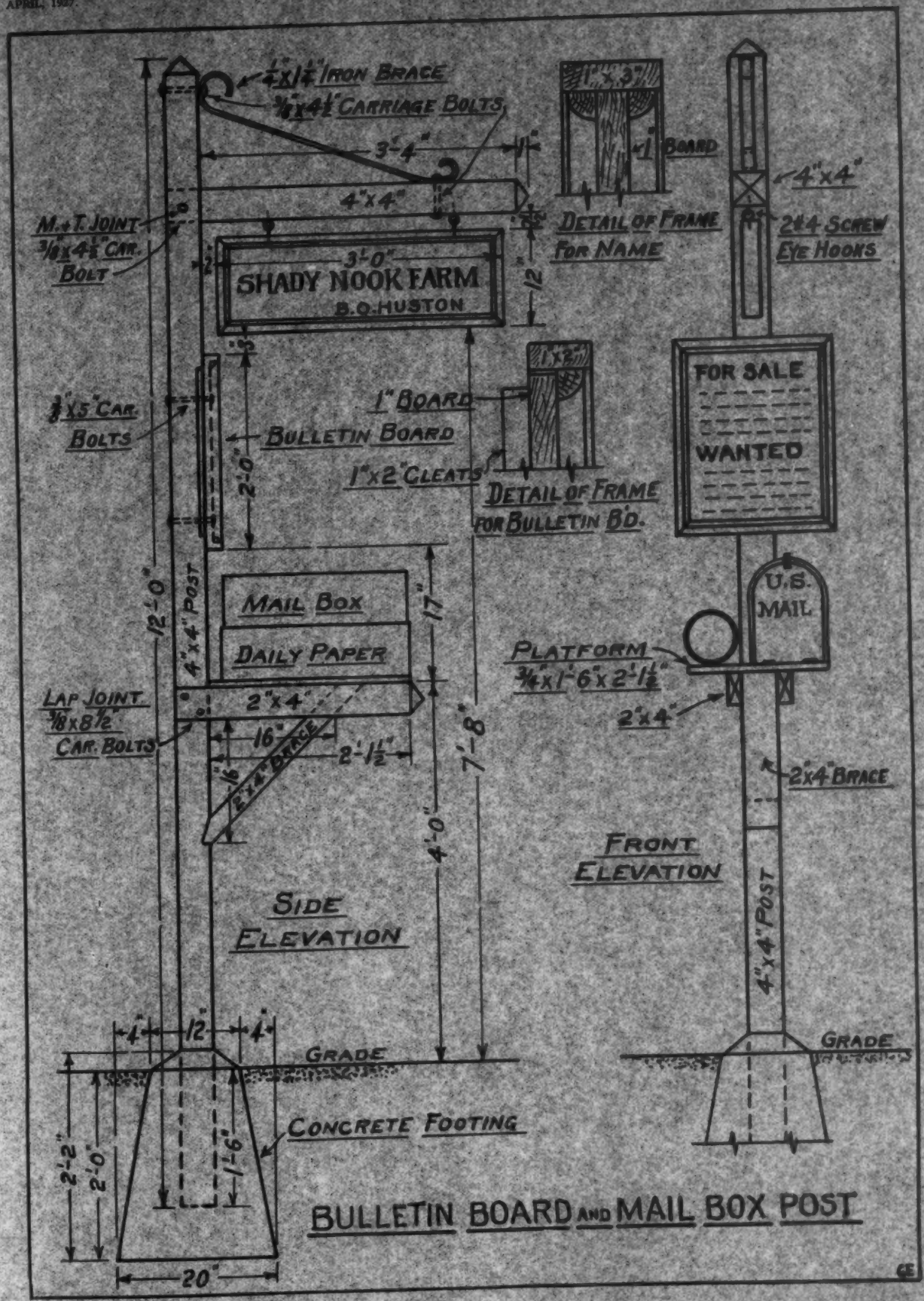

BULLETIN BOARD AND MAIL BOX POST

Designed by E. B. Farr, Everett, Wash.

For Details see Page 148, Industrial Arts Magazine, April, 1927

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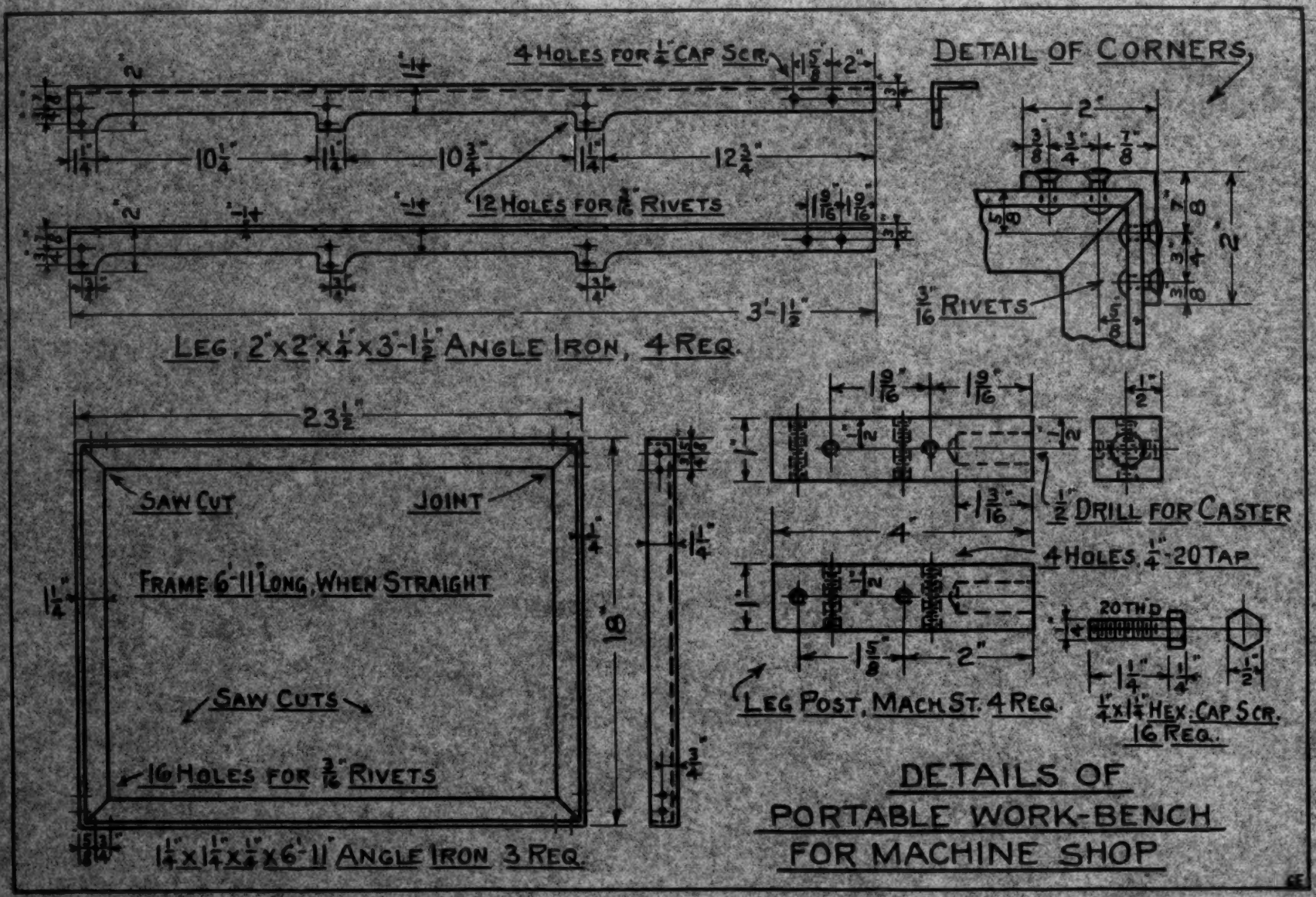

DETAILS OF PORTABLE WORK-BENCH FOR MACHINE SHOP

Designed by Walter H. Dreher and Fred J. Fisher, Irvington, N. J.

For Details see Page 148, Industrial-Arts Magazine, April, 1927.

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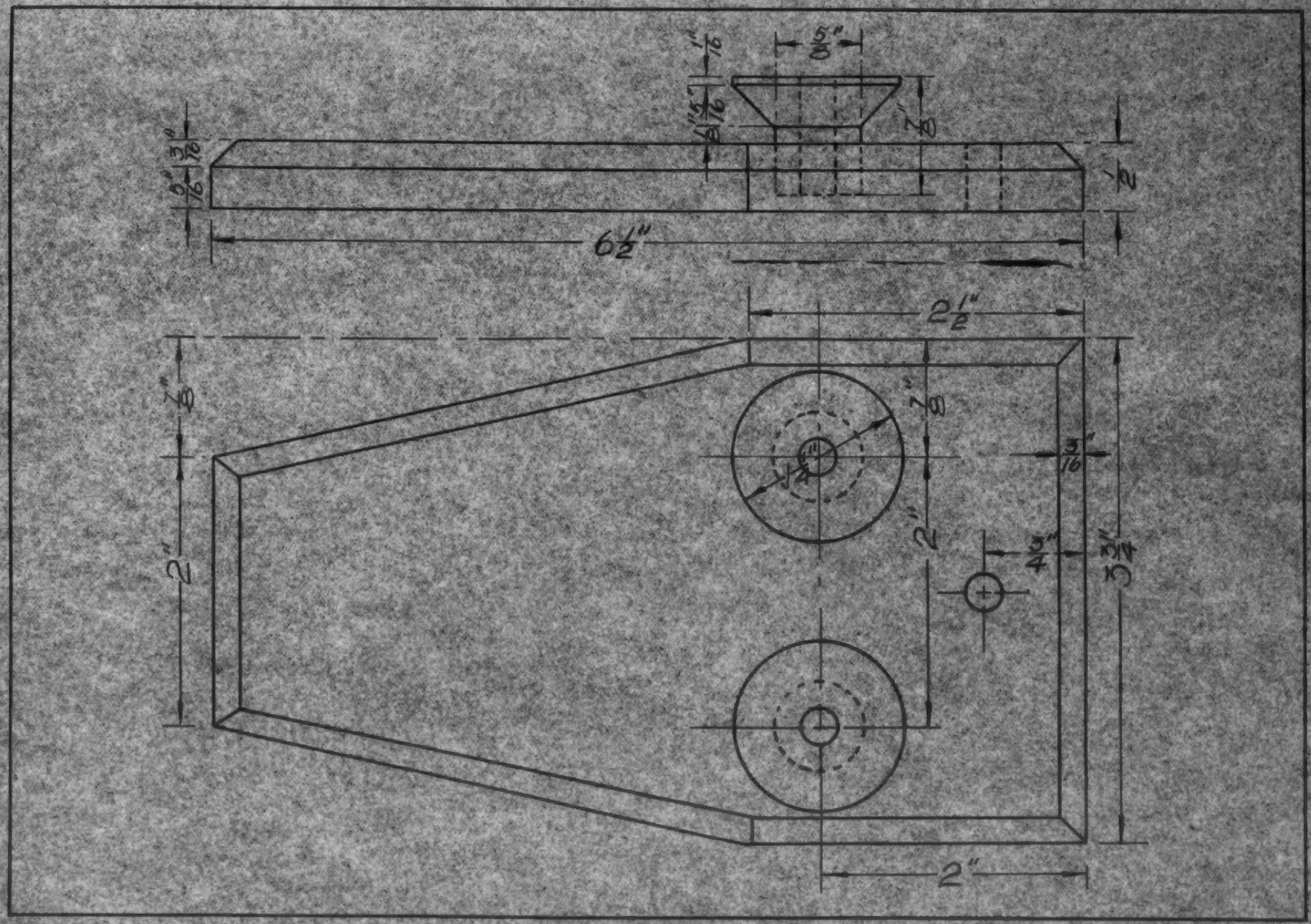

Designed by Alfred J. Bent, Yonkers, N. Y.

For Details on Page 144, Industrial Arts Magazine, April, 1927.

TRACING SUPPLEMENT No. 31
THE INDUSTRIAL ARTS MAGAZINE
APRIL, 1927.

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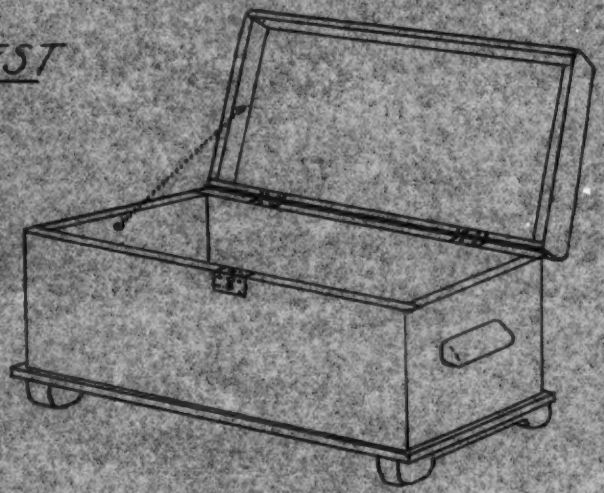
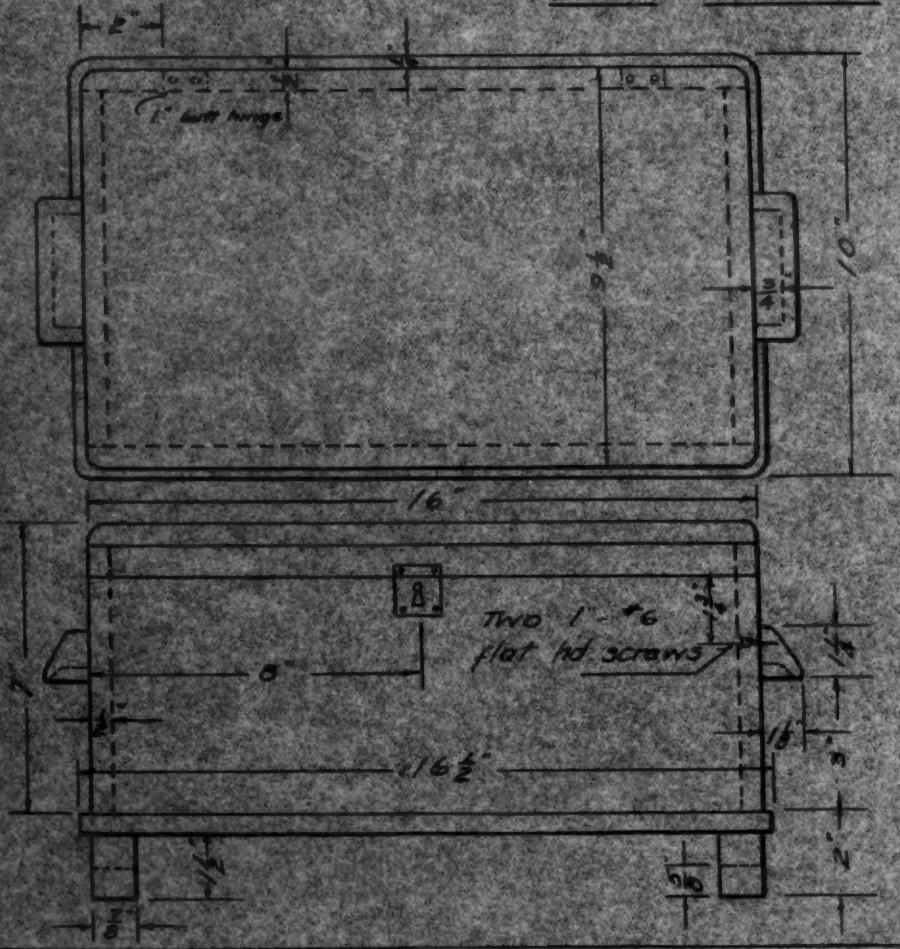
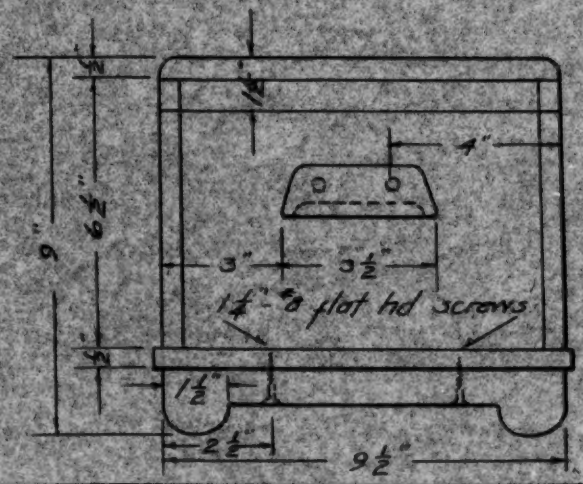
DOLLS CLOTHING CHEST

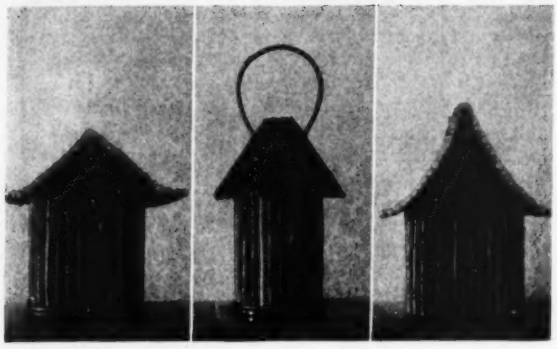






Drawing by Lois M. Stiner, Hudson, Ohio.

For Details see Page 148, Industrial-Arts Magazine, April, 1927.



(LEFT TO RIGHT): WREN OR BLUEBIRD HOUSE; WREN HOUSE; WREN OR BLUEBIRD HOUSE.

In making the entrance, a $\frac{7}{8}$" section of one willow may be cut out, then each willow at the side of this may be cut with the knife until the proper size is reached. If possible, do not cut the willows on the sides into sections. Fig. II. It is important to cut the entrance at the right height, for if it is too low the young birds have an opportunity to get out of the house before they are strong enough to protect themselves from enemies.

After the entrance has been completed and the bottom fitted, the house is ready to be assembled. The willows are bent around the bottom and the ends of wires may be brought together and twisted to hold and draw the willows tightly together. The bottom is fastened by means of brads. It is not necessary to put a brad in each willow; five or six brads will be sufficient to hold the bottom tightly. Fig. III.

The bottom is most important in supporting and determining the shape of the house. The willows can be bent to meet practically any shape. Fig. IV.

The roof of the house is made in the same manner as the walls. The roof may be made of straight willows of a smaller diameter. This requires more willows but makes a neater-appearing roof.

A question here arises as to the rain. How can rain be kept out? The roof, or even the sides of the house, can easily be made wind or rain-proof, by placing underneath the logs of the roof and inside the house some heavily waxed wrapping paper. The roof of the house is fastened over this paper by means of wire. The roof may be wired on so that it can easily be taken off in case there is need of cleaning the house.

When the house is completed it may be decorated by binding the base with several thin willows, fastened by means of small box nails. Steaming for bending is not required.

The curved handle of the round wren house is made from a willow $\frac{3}{16}$" in diameter. This handle is absolutely safe from breaking or tearing, for it has a core of copper wire pushed through the pith. Each end of the handle may be fastened to the roof with this center wire. It will be necessary at first to work a fairly stiff wire through the pith.

The roof of the round-type wren house is more difficult to make than the other types of roof. This roof is held together by four strands of wire. The method of construction may be observed in Fig. V.

In making these houses a variety in color can be obtained by alternating a white sapling with the red willows as was done in the round wren house.

These houses may be suggestive in the making of other styles and kinds of rustic houses of this type. They are also suggestive in the making of porch baskets, plant boxes, and the like.

PIRNTING SPECIMENS

C. M. Litteljohn, Seattle, Wash.

Inasmuch as the average school print shop possesses at best but comparatively few fonts of type, often as little as two or three, the printing instructor feels somewhat handicapped, constrained or circumscribed by lack of equipment in developing printers who have a comprehensive knowledge of the craft, and a versatility in the use of a wide range of types and type faces.

Each printed expression of a thought, each separate composition may require different style types for its dress and setting, its bearing, character, and atmosphere which serve to reflect the spirit, tone, and very essence of the message or printed composition.

Nearly every school print shop in the country finds it necessary constantly to seek larger appropriations for the purchase of more equipment and more varied type faces, ornamentation, and typographical robes of one sort or another. But it is almost impossible for the school to secure all that it may request in this direction, or all in fact that it may need. School boards manifestly cannot equip print shops like a million dollar printing institution operated successfully day by day in the commercial field, and doing a sufficiently large volume of business to warrant the purchase of extensive equipment and many type faces.

Printing instructors, therefore, often find it necessary in order to inculcate high printing standards and a diversity of uses of type through precept and example furnished by the excellent specimens for which they are always vigilant, with a weather-eye peeled for attractive "jobs."

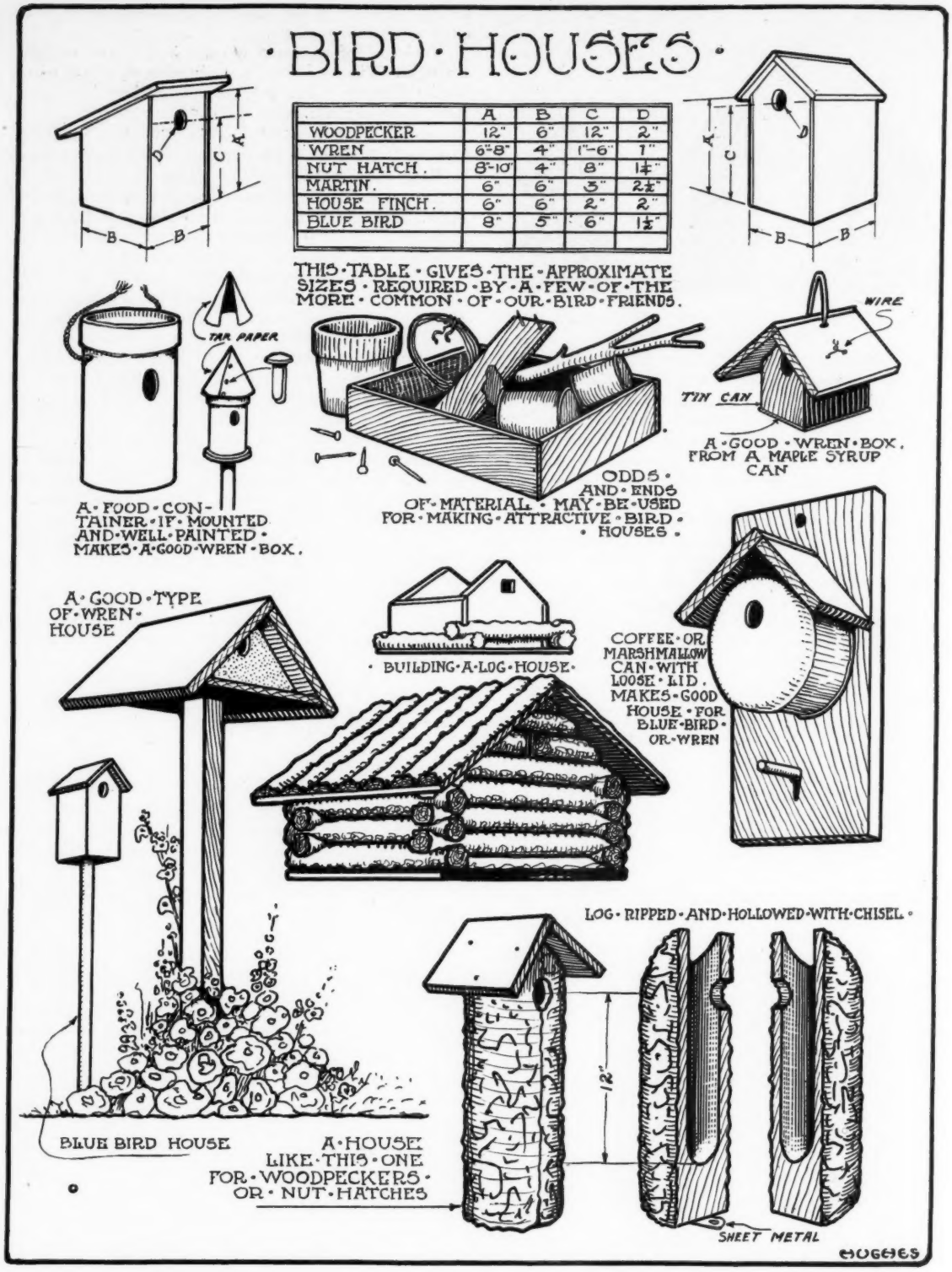
Printing of merit wherever found may be collected by the instructor and incorporated in a definitely organized specimen file, or cabinet, where he may analyze the style, or composition, and discover latent reasons for the selection of certain styles of type faces, points ornamentation, designs, borders, and typographical arrangement which may have inspired the creator of these pieces of outstanding printing art.

Specimens if selected with due regard to high standards of excellence, appreciation of beauty, or an idea of variation, originality and diversification, may overcome in some measure the lack of equipment and the consequent loss which may be felt in having only a few fonts of type which the students learn to handle with facility.

Each good insert used from time to time in the printing publications to which the school printing instructor subscribes, may furnish a specimen for his file, or the folio that becomes a necessary adjunct to his class instruction, and demonstration methods.

Notable examples that may come to his individual attention from other sources, such as the direct-mail advertising which embodies some of the highest printing art, or the magazine advertising of the present day, and reaching his desk each morning from the mails, may be grist for his mill.

If thoroughly analyzed and digested and the beauty and harmony that is apparent in them dissected by a skillful laboratory method, an insight into the reasons which prompted the printer to prefer Caslon, Bodoni, or Garamond type faces, certain initials, kinds of margins for the *toute ensemble* and the artistic effect achieved, may be realized. And with the thorough appreciation which perforce comes from their constant study, each of the printed specimens may serve not only to inspire the members of the printing class, but may form the basis of a short lecture on the striking points of these specimens collected by the printing school instructor.


BIRD HOUSES
A
B
C
D
WOODPECKER 12" 6" 12" 2"
WREN 6"-8" 4" 1'-6" 1"
NUT HATCH. 8"-10" 4" 8" 1¼"
MARTIN. 6" 6" 3" 2½"
HOUSE FINCH. 6" 6" 2" 2"
BLUE BIRD 8" 5" 6" 1½"
THIS TABLE GIVES THE APPROXIMATE SIZES REQUIRED BY A FEW OF THE MORE COMMON OF OUR BIRD FRIENDS.
TAR PAPER
A FOOD CONTAINER IF MOUNTED AND WELL PAINTED MAKES A GOOD WREN BOX.
ODDS AND ENDS OF MATERIAL MAY BE USED FOR MAKING ATTRACTIVE BIRD HOUSES.
WIRE
TIN CAN
A GOOD WREN BOX. FROM A MAPLE SYRUP CAN
A GOOD TYPE OF WREN HOUSE
BUILDING A LOG HOUSE
COFFEE OR MARSHMALLOW CAN WITH LOOSE LID. MAKES GOOD HOUSE FOR BLUE BIRD OR WREN
LOG RIPPED AND HOLLOWED WITH CHISEL
12"
BLUE BIRD HOUSE
A HOUSE LIKE THIS ONE FOR WOODPECKERS OR NUT HATCHES
SHEET METAL
HUGHES

BIRD HOUSES

F. C. Hughes, Spokane, Washington

In the life of nearly every boy comes the attempt or effort in the direction of bird-house construction. It seems to be one of the outstanding items of interest in his experiences. This may be because of the play spirit attaching itself to the building of any kind of models, but more likely the bird-house construction derives its attractiveness from the interest that the individual has in the little songster which is to build its nest in the finished house.

The construction of bird houses is so simple that each boy should be able to build for himself very satisfactory models for his own back yard. The material and tools need be nothing more than what are to be found in almost every home.

Boxes, tin cans, wire, and a hammer and saw or a butcher knife, may serve to build a very satisfactory bird house.

First it is necessary to decide the kind of bird for which the house is being built, and then by using the chart of dimensions on the accompanying drawing, find how large and in general what shape to build the house.

While a few birds, such as the house wren and the bluebird, are not so choice in their selections and will in some cases built in almost any form of box, their needs should nevertheless be somewhat considered. In the case of the little house wren the size of the opening is very important, because if too large, the larger birds such as the English sparrow, may cause them much damage by getting into the house.

There are some birds common to all parts of the United States, which will not build in boxes and so cannot be provided for. There are still others which are very choice in their requirements and hard to please. Among these is the common woodpecker.

In the accompanying sketches is shown a variety of bird houses, all of which may be built from odds and ends about nearly all homes. Other types of houses may be devised, as different kinds of material and conditions present themselves.

In the case of the log house there is a great opportunity for some interesting workmanship and finishes, in fitting and shaping the logs to form real models of the old-time log houses.

The long, narrow woodpecker's house may be made from a piece of cordwood or log about 6" in diameter, ripped or split through the center and hollowed out, as shown in the accompanying drawing.

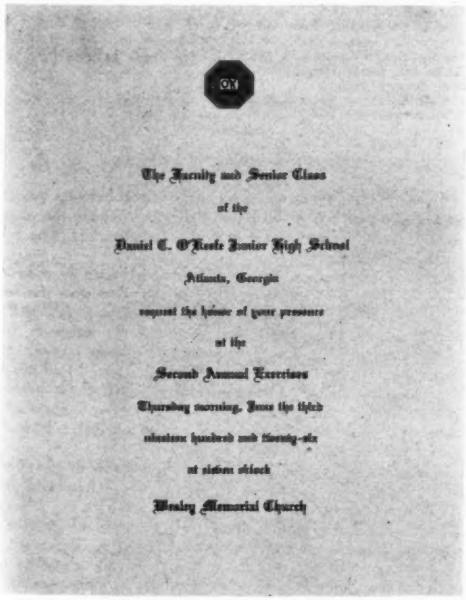
Another type of house, not shown in the drawing, is the martin house. The martin is common to only parts of the country and is one of the very few birds that will build in colonies. Some very interesting houses may be constructed, having any number of rooms and doors.

If any paint is used on bird houses, it should be confined to the duller and natural colors and never used on the inside.

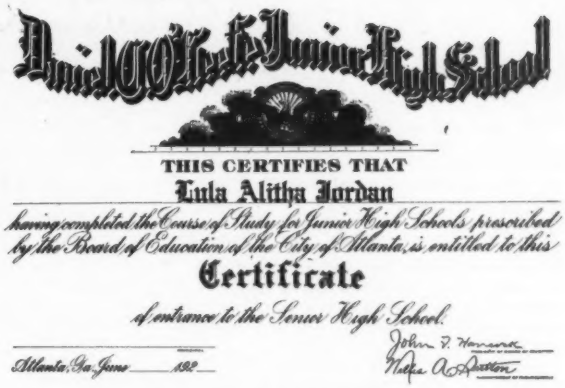
PRINTING ANNOUNCEMENTS AND DIPLOMAS IN THE SCHOOL PRINT SHOP

Vick L. Langford, O'Keefe Junior High School, Atlanta, Ga.

Expenses connected with the graduation of high-school students often become so high as to be a hardship on some of



THE ORIGINAL WAS PRINTED ON A HIGH-GRADE WEDDING BRISTOL, CONVENTIONAL SIZE.


Daniel C. O'Keefe Junior High School
THIS CERTIFIES THAT
Lula Alitha Jordan
having completed the Course of Study for Junior High Schools prescribed by the Board of Education of the City of Atlanta, is entitled to this
Certificate
of entrance to the Senior High School.
Atlanta, Ga. June 1926
John P. Howard
Nora A. Dutton

THE GRADUATE'S NAME IS IMPRINTED.

the students or their parents. Names on diplomas are usually hand lettered at a cost of one dollar per student, which is a fair price if a high-grade job is done. Announcements also come at a high rate.

The writer was given the job of printing the names on the diplomas, in the school print shop, at the rate of fifteen cents each. This was done with 48-point Engravers' Old-English type. The illustration shows a sample of the completed job. Similar engraved diplomas were furnished to all of the junior high schools in the city; only the student's name is printed in the school print shop. The work was done by the instructor outside of school hours, with the assistance of two boys who were paid for their time.

The principal decided that this was not a project for the school but should be work done for individuals, and therefore the instructor was entitled to the small sum charged the students.

Announcements were printed like the accompanying illustration at a cost to the student of five cents each, including the envelopes. Since the school colors were green and white, the school emblem was printed in green.

A School Souvenir. The general shop of the Sunbury High School at Sunbury, Pa., has issued a 24-page pamphlet describing the work of the shops. The pamphlet is fully illustrated with the portraits of the men who are conducting the shop, with interior views of the shoprooms, and with illustrations of a number of the important machines and tools in the several sections of the shop. The booklet has a novel cover imitating a section of wood. The work is directed by Mr. Wayne E. Steiner.

The printing class of the seventh and eighth grades, which is in session 12 weeks each year, issues a school paper known as "The Junior School Times." One page of the paper is devoted to school news and the second page to advertisements for the school.

The Sunbury schools operate one general shop for the entire elementary- and secondary-school system and offer courses in woodworking, electric wiring and testing, sheet metal, machine-shop practice, printing, plumbing, and foundry practice. The junior high-school classes are of the tryout type and the senior high-school classes specialize along prevocational lines. The work is offered in five separate shops handled by three teachers.

Montana Young Men's Conference. The Montana Young Men's Vocational Conference was held in February, at the Montana State College, with 1,100 boys of the state and eighteen speakers of national reputation in attendance. In all, more than 200 towns and cities representing as many high schools of the state, sent delegates to the conference. Among the speakers who discussed vocations for young men were M. A. Brannon, E. J. Klemme, D. E. Willard, H. F. Pote, Alfred Atkinson, H. C. Miller, A. J. Galen, W. R. Plew, W. M. Cobleigh, A. L. Stone, C. H. Clapp, J. M. Hamilton, and G. R. Hill.

City and County Educators Discuss Vocational Work. Teachers, principals, and other school officials of the city and county attended a get-together banquet at Lancaster, Pa., for those interested in vocational and industrial problems. Plans were completed for a permanent organization for the promotion of vocational education and the betterment of vocational schools. Speakers were Dr. Wm. Ash, Dr. H. E. Gress, Mr. Weeder, Mr. William Bourne, and Mr. C. J. Rhen.

A 1927 MODEL RADIO RECEIVER

Lloyd F. Stair, Junior-Senior High School, Madison, N. J.

THIS model was designed out of school hours and the sets installed have proved satisfactory in appearance, volume, tone, selectivity, and ability to pull in distant stations. Back of the design are four and a half years' experience in building, installing, and servicing radio receivers.

Features

1. *Circuit, Four-Tube Unreflexed Roberts.* After two years this circuit is one of the most popular of the day. It comprises one stage of tuned and balanced radio frequency; a detector with controllable regeneration which, being in the second tube, does not radiate to the antenna; and two stages of transformer-coupled-audio-frequency amplification.

2. *Audio Amplifier.* In a paper read before the Radio Club of America, Mr. Alfred W. Saunders, engineer of the F. A. D. Andrea Company, recommended the use of audio transformers. In speaking of impedance- and resistance-coupled amplifiers he said: "The limitations of these types have been admirably pointed out as follows: An impedance- or resistance-coupled amplifier cannot be perfect. If the fixed condensers are not sufficiently large, the bass notes are missing. If they are large enough to pass the bass notes, they tend to introduce a time lag in the circuit. These conditions fix a definite limit for preventing the absolutely uniform amplification of all the audio frequencies." However, there are many excellent audio *transformers* on the market, some costing three times as much as those used in this receiver, but none experimented with produce a tone any clearer or truer to the natural than Acme A-2.

3. *Tuning Condensers.* The design employs the standard, straight-line, frequency-grounded-rotor Amsco condensers. They are helpful in spreading the low-wave-length stations. These condensers are tuned by two bakelite Marco dials which are nonmicrophonic, smooth running, noiseless, and have no backlash. Amsco allocating condensers run in ball bearings, and have a wear adjustment for take-up both ways.

4. *Coils.* The coils employed are those made for the Roberts circuit by the Hammerlund Mfg. Co. The coils are of the low-loss, air-core type and are substantially made up with silk-covered copper wire.

5. *Sockets.* To keep microphonic noises out of the speaker, the Benjamin universal cushion sockets are excellent. These are employed. Benjamin sockets have bakelite bases.

6. *Panels.* It is worth while to use bakelite. Hard rubber has a tendency of turning color with age to shades of gray and brown. Bakelite keeps its black color indefinitely.

7. *Volume Adjustment.* This is by means of a 3-ohm Carter imp rheostat in series with a 3-ohm fixed resistance to regulate the filament consumption of the first three tubes. The fixed resistance prevents the filaments from being lighted too bright for their good.

8. *Tone Adjustment.* This control takes care of the regenerative coupling in the radio-frequency coupler. When the first tube is balanced properly by the X-L neutralizer, this action is smooth and gradual.

9. *Allowance for Power Tube.* The last socket has means of varying the A, B, and C battery voltages according to the type of tube used. The UX-201A is satisfactory, but with the new UX-171 greater volume is possible. This tube draws 40 volts C-battery and 180 volts B-battery.

10. *Variable Antenna Coupling* is obtained by means of pee-wee clips.

11. *Wiring.* Except for the leads to the coils and the audio transformers all the wiring is below the subpanel. Binding posts on the sockets are reversed and longer bolts are put in to bring them below. All wiring is done with flexible, spaghetti-covered celatsite wire, making the shortest leads possible by a direct point-to-point system of wiring. This has electrical advantages over bus-bar wiring with its corners and enclosed loops. The engraved binding posts are placed at the rear of the subpanel. The grid leads are as short as possible to avoid undesirable feed-backs.

12. *Two Tuning Controls.* The designer has not tried to incorporate any one-dial-control system. Double condensers usually have shafts in common. This is unfortunate since the grid circuits of the first and second tubes do not return to the same side of the filament circuit. Condensers and coils do not tune uniformly over the whole wave band. Hence in sets using an outdoor antenna some means must be provided for sharpening the antenna tuning. Therefore, a small auxiliary control is necessary, with a so-called one-dial system. This really makes two controls. The writer considers it better to have two separate condensers to achieve sharp tuning, to keep the filament returns right, and to avoid the losses due to close proximity of double condensers.

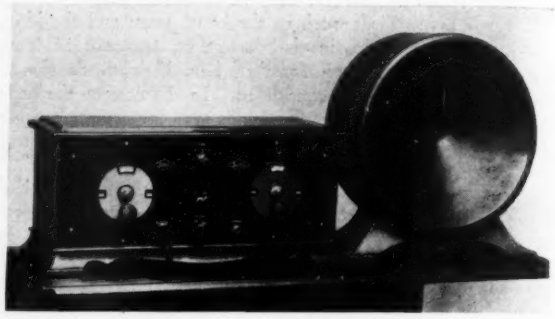


FIGURE 1. STAIR RECEIVER SHOWN IN A COMMERCIAL 7"x18"x8" MAHOGANY CABINET WITH AN ACME CONE REPRODUCER.

Tools Recommended

1 Pair long-nose side-cutting pliers.
1 Stevens T-580 reamer.
1 Stevens Spintite round-nut wrench (No. 6R).
1 Stevens Spintite hexagonal-nut wrench (No. 5, for med. 6/32 nuts).
1 Stevens Spintite hexagonal-nut wrench (No. 8, for jacks, switch).
1 Electric soldering copper.
1 Medium-size screw driver.
1 Screw driver, with blade ½" wide.

Screws and Nuts (Nickeled Brass)

4 ⅛" x No. 6 Round-head machine screws.
2 ¼" x No. 6 Round-head machine screws.
18 1" x No. 6 Round-head machine screws.
44 No. 6 Medium hexagonal nuts.
8 ¾" Soldering lugs.
6 ⅜" x No. 5 Oval-head wood screws (panel to cabinet).

List of Parts and Key to Abbreviations.

1 7x18x$\frac{3}{16}$" Bakelite panel—engraved and drilled	$ 4.50
15x16½x$\frac{3}{32}$" Bakelite subpanel—drilled	2.75
1 Pair Benjamin brackets	.70
4 Benjamin universal sockets—(S-1, 2, 3, 4)	3.00
1 Yaxley No. 1 jack—(J-2)	.50
1 Yaxley No. 6 jack—(J-1)	1.00
1 No. 10 battery switch—(SW)	.50
1 Carter imp rheostat, 3 ohm—(R-1)	1.00
1 Carter RU 3-ohm resistor—(RU-1)	.15
1 Carter RU 15-ohm resistor—(RU-2) } In parallel	.15
1 Carter RU 20-ohm resistor—(RU-2) }	
2 Amsco SLF condensers, .0005—(C-1, 2)	8.50
2 Acme A-2 audio transformers—(A. T.-1, 2)	6.00
2 Marco vernier dials, counterclockwise, No. 192	5.00
1 Kurz-Kasch knob, No. 702	.30
12 EBY binding posts—1 long antenna, 1 antenna, 1 ground, 1 A—, 1 A+, 1 B—, 1 B+ det., 2 B+ amp., 2 C—, 1 C+	1.80
1 Dubilier micadon, .00025, Type 601-G—(C-5)	.45
1 Dubilier micadon, .00025, Type 601—(C-4)	.35
3 Dubilier micadons, .002 Type 601—(C-6, 7, 8)	1.20
1 Daven glastor 2 meg.—(R-2)	.50
1 Set Hammarlund Roberts coils (H.R. 2)—(1 A.C., 1 R.F.C.)	7.50
1 XL Radio lab. variodenser, N—(C-3)	1.00
1 Celatsite battery cable	1.00
1 25-ft. Coil flexible, green. celastsite wire	1.00
1 Box Kester rosin-core solder	.25
Screws and nuts	.50
	$49.75

Assembly of Parts

1. *Panels.* The writer recommends drilling bakelite panels in a high-speed drill press. If a drill press is not at hand, the alternative is to buy at least the front panel drilled and engraved. The subpanel may be drilled with a high-speed hand drill.

If a number of panels are to be drilled, it is better to make a sheet iron template. Lay a blue print of the boring plan over the template and hold it firmly with a weight. With a sharp-pointed steel, sheet-metal punch and hammer locate the centers of the holes on the template. Drill these $\frac{3}{32}$". Then make a frame deep enough to hold three panels (at a time) with the template on top. Hold the panels and the template in place with turnbuckles. Drill three panels with a $\frac{3}{32}$" drill. Remove the panels from the frame and rebore each for the various sizes of holes. Countersink where marked. This method is repeated until all the panels are drilled.

In bolting together the front and subpanels with the Benjamin brackets use flat-headed screws in the upper of the two holes in front panel. There are screws in the box with the brackets.

2. *Sockets.* Take out binging-post screws and replace them with inverted 1" x No. 6 r. h. machine screws. Tighten up the screws with nuts under the springs. In mounting the sockets on the subpanel, ream cut holes if they do not slide into place easily. The arrow on the top of the socket points to G binding post, so consult plans to get the socket on right. There are to be two nuts under the subpanel for each binding post. First, draw the sockets down snug

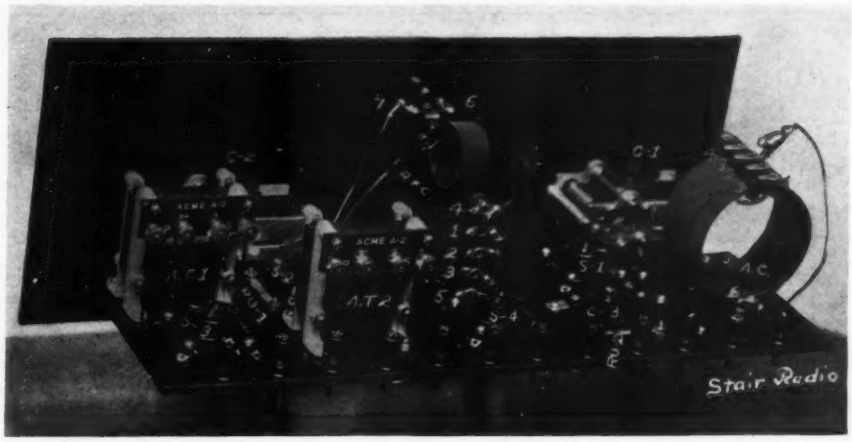


FIGURE 2. BEHIND THE PANEL.

(but do not tighten too much) with hexagonal nuts. Then use the round nuts later to hold the wiring in place.

3. *Other parts on Subpanel.* Consult the plan as to the location of the various parts. In mounting RU-1 and RU-2, use ⅜" x No. 6 r. h. m. screws with soldering lug and head of the screw under the panel. Tighten with nuts above the subpanel, place on RU and then hold the latter in place with two more nuts. If at some time you want to change and put in a different RU, you may do so without having the screw fall out underneath. Mount various Dubilier condensers in the respective places with the ½" x No. 6 r. h. m. screws removed in reversing the socket binding posts. Notice that contact 2 on C-5 mounts directly under G of S-2. Place X-L (C-3) in place so that the engraving on top is readable from the back of the subpanel. This is important. Mount with ¾" x No. 6 r. h. m. screws with soldering lugs underneath. Mount A.T.-2 and A.T.-1 with ½" x No. 6 r. h. m. screws. In fastening EBY binding posts in place, point-solder lugs in the direction shown in the wiring plan.

The Antenna Coupler. This is mounted to the subpanel with two 1" x No. 6 r. h. m. screws through eyelets. By connecting a wire from under the head of the screw to soldering lugs on the secondary coil, these bolts are used as binding posts 5 and 6 underneath. Place with primary coil toward back.

4. *The Front Panel.* Place the Yaxley No. 10 battery switch in the position engraved "Off-On," with contact lugs towards the bottom of the panel. Tighten the large hexagonal nut with a Stevens No. 8 socket wrench to avoid scratching the panel and nut, which happens if pliers are used. The next best tool would be a monkey wrench.

Mount Carter imp 3-ohm rheostat with contacts toward the phone jack, J-1. Set the knob in place with a narrow screw driver so that the arrow points upwards with the rheostat half turned on. Use a socket wrench again in tightening the jacks in place. J-1 goes in the hole marked "phones," and J-2 in the hole marked "speaker."

Open the Marco No. 192 dial packages. Tear open the envelopes contained inside. Put the set screws in place in the dials. The other bolts are used on the front panel, directly under the large holes for C-1 and C-2, to keep the Marco dials in place. Put them in place and tighten with the head of the bolt out. Before fastening C-1 and C-2 in place, test to see if the condensers turn smoothly without touching. If too loose, there are take-up adjustments. Consult Fig. 2 for the placement of R.F.C. Knob No. 702 is placed on the shaft of R.F.C. Turn the shaft to the left all the way and set the pointer of the knob at the first division on left. Set the Marco dials in place so that the dial reading is 100 when the plates of the condensers are entirely meshed.

Wiring

First a word about soldering. It is necessary to have a *tinned* soldering copper, whether you are to heat it by gas or electricity. Dirty coppers will not solder. The tinning process is as simple as this. The copper is heated so that it feels hot when an inch from the cheek, but it must not be red hot. File it clean, melt solder and flux on the tip and wipe with a cloth. Keep a small cloth handy to brush dirt from the tip now and then. If you do not overheat the copper, it will stay tinned indefinitely. The advantages of electric soldering coppers is that a uniform heat is kept, and they can be kept plugged in until the soldering is completed. Use rosin-core solder only in soldering radio apparatus. Do not use paste or acid flux, as neither will hold over a space of time. Acid corrodes the joint and will let go finally.

On this receiver, do not solder to any nuts, bolts, or bolt heads. Solder only to regular soldering lugs where they are provided.

It is well to test the parts before wiring for open-and-closed circuits. The following parts should be open (have no circuit between contacts): Sockets, jacks, and all condensers. These should have circuit between contacts: Primary of A.T., secondary of A.T., all

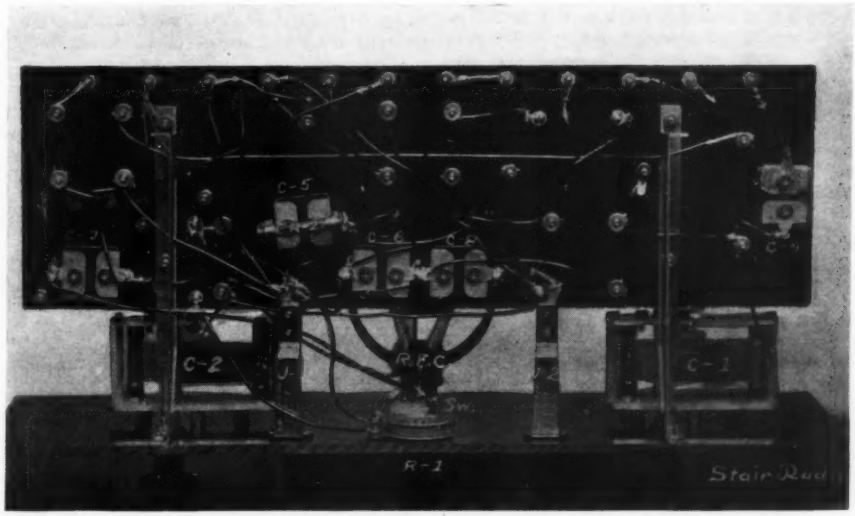


FIGURE 3. BENEATH THE SUBPANEL. (PLACE THE RECEIVER IN THIS POSITION WHEN YOU WIRE. THIS CHECKS WITH THE SUBPANEL WIRING PLAN IN FIGURE 4.)

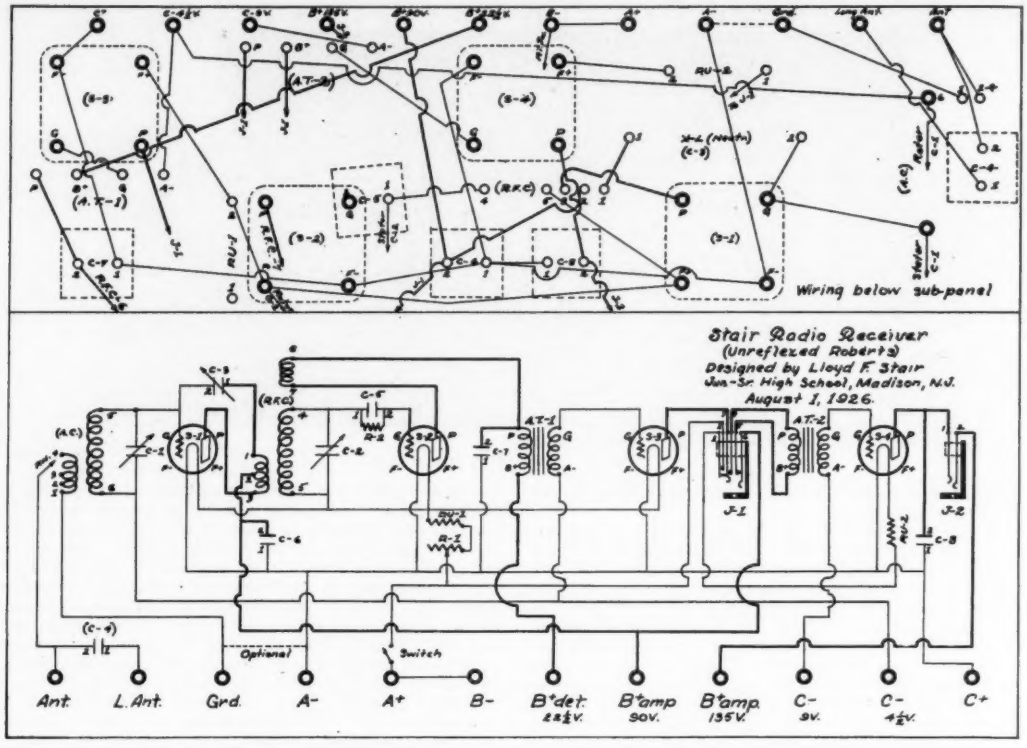


FIGURE 4. WIRING PLAN BELOW SUBPANEL AND TECHNICAL WIRING DIAGRAM.

resistances, primary of coils, secondary of coils, and tickler coil. Here are two methods of testing: (1) With phones and C battery listen for click denoting a closed circuit; (2) with B battery and heavy resistance 0-50 voltmeter the reading will vary with the resistance of the wiring. The primary of audio transformers gives a higher reading than the secondary.

In cleaning the insulation from celatsite or any wire, use a small, sharp knife blade. Remove the insulation with a slicing motion, being careful never to cut at right angles to the wire. Twist the ends of the stranded wire. Attach the wire to one contact and then measure and cut the wire to right length. Wire should be looped over the soldering lugs and tightened before being soldered. Let the soldering copper heat up both the wire and the lug and then let one drop of solder run into the heated connection. Solder will not stick if it is only dropped on.

1. *A— Battery Leads.* It will help you if you follow Figs. 2, 3, and 4 along with these instructions. Start with the A— binding post and wire to F— on S-1, to 1 on C-6 and 1 on C-8, to F— on S-4, to F— on S-2, to 1 on C-7, to F— on S-3, to C+ binding post. Now again from the A+ binding-post wire to the B— binding post, to the contact on Sw. toward J-2, from other Sw. contact to R-1 and to 2 on J-1. From other contact on R-1 to 1 on RU-1, from 2 on RU-1 to F+ on sockets 3, 2, and 1, to rotor on C-2, to 5 on R.F.C. From 1 on J-1 (top contact) to 1 on RU-2, from 2 on RU-2 to F+ on S-4. This wiring to J-1 and through RU-2 to S-4 is for the purpose of cutting out the last tube when phones are used. J-1 has a filament cut-out attachment at the top. Care should be taken not to short this A+ wire with the other J-1 contacts which carry high voltage.

2. *Dubilier Condensers.* Wire from 2 on C-6 to 2 on R.F.C., to 6 on J-1, to B+ amp. (90 v.) binding post. Wire from 2 on C-7, to P on A.T.-1, to 6 on R.F.C. (Consult Fig. 2 for R.F.C. connections.) From 2 on C-8 wire to P on S-4, to 1 (upper) on J-2 (Fig. 3). From 1 on C-4 wire to long antenna b. post. From 2 on C-4 wire to antenna post, to pee-wee clip for variable tap on 2, 3, and 4 A.C. Notice that 2 on C-5 is mounted directly on bolt for binding post G on S-2. From 1 on C-5 wire to 4 on R.F.C., to stationary plates on C-2 (Fig. 3).

3. *From Binding Posts.* Wire from ground b. p. to 1 on A.C. You may also wire to A—. This connection tends to make louder reception with broader tuning. From B+ det. b. p., wire to B+ on A.T.-1. Wire from B+ amp. (90 v.) b.p. given with C-6 instruction. Wire from B+ amp. (135 v.) b.p. to 2 on J-2 (lower). Wire from C-9 v. b. p. to A— on A.T-2. Wire from C— 4½ v. b.p. to A— on A.T.-1, to 6 on A. C., to rotor on C1-. Wire from C+ b.p. given with A—.

4. *Other Socket Connections.* Wire from 2 on XL to G on S-1, to 5 on A.C., to stationary plates on C-1. From 1 on XL to 1 on R.F.C. (Fig. 2). From 3 on R.F.C. to P on S-1. Wire from 7 on R.F.C. to P on S-2. Wire from G on A.T.-1 to G on S-3. Wire from 3 on J-1 to P on S-3. Wire from G on A.T.-2 to G on S-4.

5. *Second Audio Transformer.* (Figs. 3 and 4.) Wire from P on A.T.-2 to 4 on J-1. Wire from B+ on A.T.-2 to 5 on J-1.

(Note: 1 on J-1 is at top, 6 on J-1 is at bottom.)

Aerial and Ground

For sharp, selective tuning, the total of the suspended aerial plus the lead-in wire should not exceed 100 feet. Place the set so that the lead-in may be kept short. In making connections outdoors, such as insulated wire to stranded wire, or insulated wire to ribbon window lead-in, clean the joint surfaces well and solder with an alcohol torch or soldering iron. It is permissible here to use Kester acid-core solder. Unsoldered joints corrode outdoors and after a short time one half of the joint becomes insulated from the other by the corrosion.

Use a ground clamp for attaching ground wire to a water or steam pipe. Where there is no water system, a second aerial often makes a fine ground substitute.

Testing With 6-Volt A-Battery

After checking over the wiring, retighten the nuts under the binding posts. Then connect the negative of the 6-volt A-battery to the A— binding post. Do likewise with the A+ to A+ b. p. Put four UX-201A Radiotron or CX-301A Cunningham tubes in the sockets, noticing the direction-marker pin on the various sockets. If the tubes all light up when you turn on the switch, remove them.

Next connect the negative of the A battery to the B— binding post and the positive of the A battery to the B+ det. binding post. Put the tubes in. They should not light. Test likewise with the A+ wire to both B+ amp. binding posts. If the tubes light, there is a wrong connection, and you must check over your wiring with Fig. 4 to find the error.

Connecting Up the Batteries

When the preceding test checks, connect all batteries to the binding posts, using the battery cable for A and B batteries. Always connect wires first to the set and then to the batteries. Reverse this order when disconnecting batteries to avoid shorting the batteries. Put the C battery behind the set to keep the leads short. Do not use battery cable for B—, but connect directly from B— to A+ on batteries. Disregard B— binding posts unless you can find a six-wire battery cable.

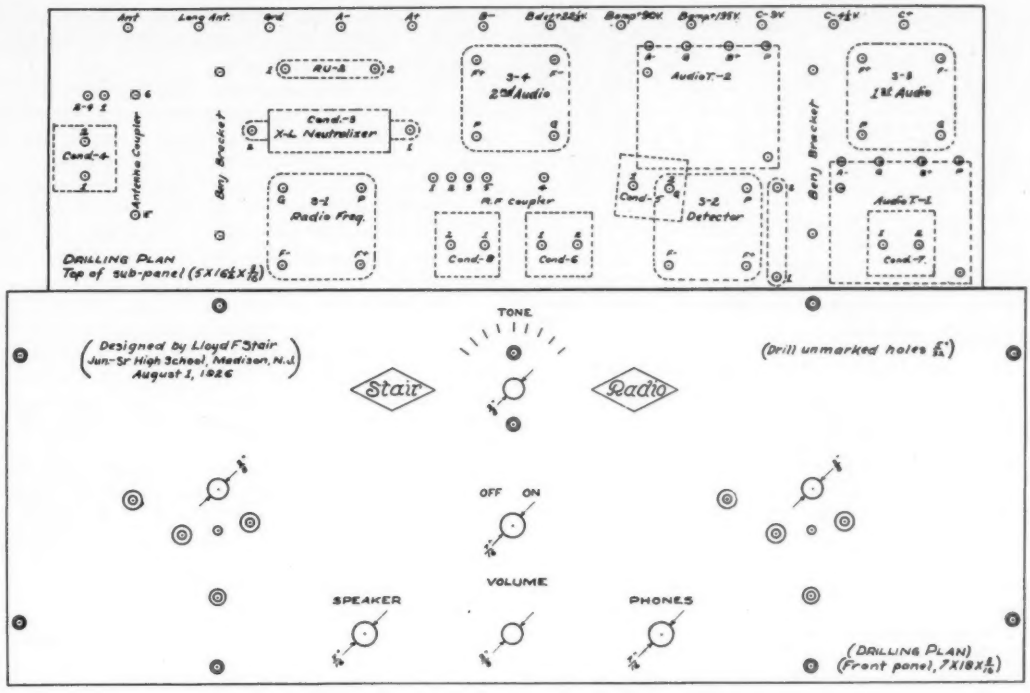


FIGURE 5. DRILLING PLAN FOR FRONT AND SUBPANEL.
The author is prepared to supply full-size blue prints of the drilling plan.

Balancing First Tube by X-L Neutralizer

Attempt to tune in a station around 35 on the Marco dials. Have the volume and tone controls turned about two thirds on from left to right. Have the pee-wee clip on the antenna coupler at tap 3 (Fig. 2). Before the radio-frequency tube is neutralized, you may hear only a whistle from the station along with distorted speech or music. Now with a screw driver adjust the center screw on X-L (C-3) until you can tune in all low-wave-length stations smoothly. This adjustment is very critical.

If you get a humming sound which builds up gradually when you do not operate the controls, interchange the tubes until you overcome the difficulty. Sometimes a new tube which does not function well as a detector, will work as an amplifier, and vice versa.

THE HIGH-SCHOOL TEACHER AND VOCATIONAL GUIDANCE

Much is being done and more said about developing vocational guidance programs in city-school systems. Directors of vocational guidance have been appointed in a number of cities and vocational counsellors are becoming more numerous each year; courses in occupations are found in many junior and senior high schools and placement of pupils who would leave school to begin wage earning is becoming recognized more and more as a school function.

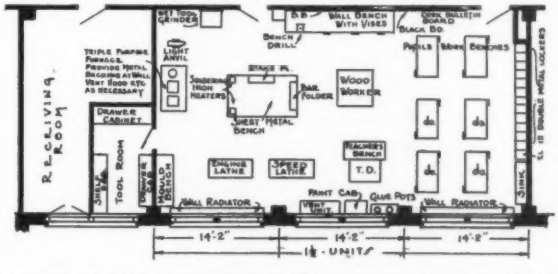
Mr. George Myers, in an article in the "Michigan Vocational News Bulletin," calls attention to the need of vocational-guidance work on the part of teachers of the regular school subjects. He writes as follows:

"Both in progressive and in unprogressive school systems there is valuable vocational-guidance work which may be done by teachers of regular school subjects. The teacher of general science may call the attention of his pupils to a number of occupations suggested by the subject matter of the course, discussing briefly with them the requirements and opportunities of each occupation. Teachers of mathematics, physics, and chemistry may do the same, giving particular attention to the various branches of engineering. Teachers of industrial arts, of agriculture, and of commercial subjects will find many opportunities to acquaint pupils with what is necessary for success in certain of the skilled trades, in different types of farming, and in several kinds of office work. Teachers of household arts, even though the subject be taught with no thought of preparation for any other occupation than homemaking, may easily direct the thought of their pupils to the requirements and opportunities of dressmaking, lunchroom, and cafeteria cooking and management, interior decorating, nursing, and the work of a dietitian. In fact every teacher in junior and senior high school has a chance to help his pupils obtain information concerning one or more occupations closely related to the subject he is teaching; while the teacher of a tryout course who fails to do this is neglecting a vital part of his work.

"Presenting occupational information to high-school pupils by the various subject teachers may be made part of a class exercise now and then, when the subject matter of the course lends itself readily to this, or the teacher may impart it to the pupils in informal conferences with individuals, or pupils may be guided in looking up the needed information for themselves, or these methods may be combined. In whatever way the job is done the average teacher will find himself seriously lacking in the information needed, and in knowledge of the most effective methods of accomplishing the desired results. If the job is to be done right, teachers in junior and senior high schools should have enough training in vocational guidance to appreciate its meaning, to know what information concerning an occupation is needed as a basis of choice, how this information may be obtained, and how it may best be 'put over' to the pupils. Such training would also make these teachers sympathetic and ready to cooperate with whatever organized vocational-guidance work is carried on in the school system. Every junior and senior high-school teacher who wishes to be as helpful as possible to his pupils will find a rare opportunity in vocational guidance, **if he is prepared to give the right kind of help.**"

OVERALLS VS. THE WHITE COLLAR

Paul B. Douglass in an article printed in *System* holds that "wage earners are bettering their situation faster than do the salaried employees." He continues: "In real dollars—dollars of purchasing power as determined by the index of the cost of living—the clerical worker earned $965 thirty years ago, and is earning $987 today. At the same time the wage earner earned $439, while today he receives in real dollars $552. The factory worker still receives less than the salaried employee, but his real wages have increased 28 per cent, while the latter's have increased only 2 per cent."



LAYOUT OF STANDARD GENERAL SHOP, JUNIOR HIGH SCHOOLS, NEW YORK CITY, MR. WILLIAM H. GOMPERT, ARCHITECT.

PROBLEMS & PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in benchwork, machine shop practice, turning, patternmaking, sewing, millinery, forging, cooking, jewelry, bookbinding, basketry, pottery, leather work, cement work, foundry work, and other lines of industrial-arts work are desired for consideration.

BULLETIN BOARD AND MAIL-BOX POST

R. B. Farr, Everett, Wash.

(See Supplement No. 50.)

This project was developed in the writer's woodworking class, and after various members of the class had taken home and set up their posts, many of the neighboring farmers came and asked whether any of the boys would make similar posts for sale.

A neat bulletin board and mail-box post adds to the appearance of the farm and is a real utility not only for the farmer himself but also for persons who are passing, and who may be in the market for the products of the farm or who may desire to supply a need of the farmer. From the school standpoint, the project is excellent for farm-shop courses and for woodwork classes in rural high schools.

If the post is made of the stock sizes indicated in the drawing and is carefully set in concrete footing and painted, it is substantial and should give service for many years. The lettering of the sign provides an excellent opportunity for studying letter formation and color combinations. The bulletin board may be painted black so that announcements may be written with chalk.

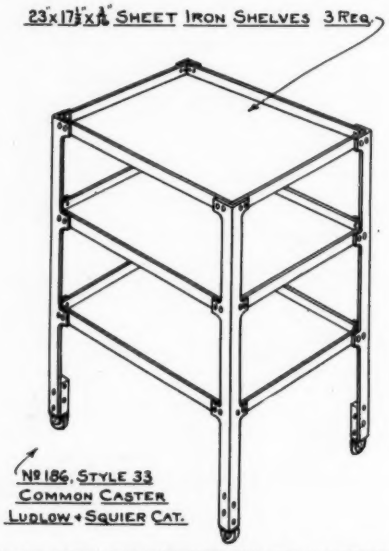
A variation of the project includes the construction of a platform for holding milk cans. Another variation includes the construction of a substantial case for holding packages.

A PORTABLE WORKBENCH

Walter H. Deichert and Fred J. Fisher, Irvington, N. J.

(See Supplement No. 51.)

The portable workbench or tool table, illustrated in the accompanying drawing, was developed for use in the machine shop of the Essex County Boys' Vocational School at West Orange, N. J. It has proved particularly useful and may be of interest to other instructors because of its neatness, rigid construction, and general utility.



ASSEMBLY OF PORTABLE WORKBENCH FOR MACHINE SHOP.

The bench rolls very easily and has been found to be useful in connection with various machines, particularly the milling machine. When a boy wishes to transfer the dividing head or vise to or from the milling machine, he can readily do so by raising the table to the height of the bench and sliding it off without danger of injury to himself from a heavy lift. The shelves are made of 3/16" sheet iron and a sheet of Bristol board or cardboard is laid on each shelf to reduce the noise.

The castors are of the swivel type. The angle-iron uprights which form the corners or legs are milled down for appearance to the same width as the angle irons used for the shelves. The angle irons which form the shelves are made in one piece, and the corner where the joint is made is alternated so that each joint is in a different corner. That is the reason why the bench is so rigid.

If it is felt that the making of the shelf with three bends is too big a job for a boy, it may readily be made in two pieces. The pieces then will be 2'-6" long before bending. It is necessary to remember, however, that the joints shall be placed alternately and not one under the other.

The bench may be bolted together with ¼" bolts, but 3/16" rivets make a more rigid and neat job.

It is well worth the time to paint the bench with black paint.

A SHEARS HOLDER

Alfred J. Bates, Yonkers, N. Y.

(See Supplement No. 52.)

This problem requires practically no explanation. Any soft wood may be used, but advanced pupils will probably better enjoy the project if they use a hard cabinet wood. The complete holder may be stained and varnished, or enameled.

DOLL'S CLOTHING CHEST

Leon H. Baxter, Hudson, Ohio

(See Supplement No. 53.)

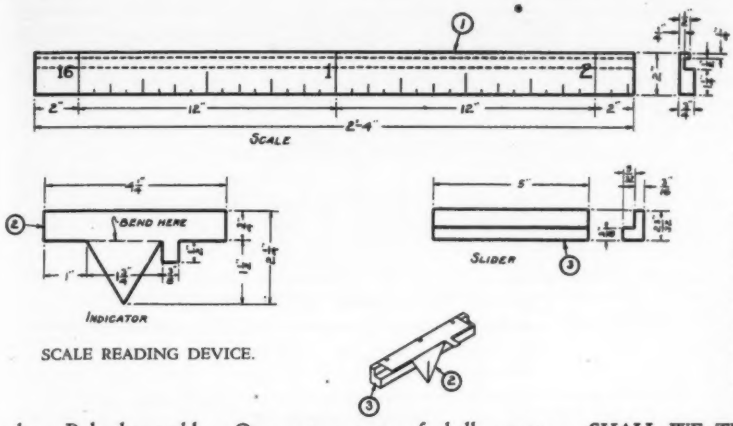
Every little girl will be delighted with this chest in which to place her doll's clothing. The chest can be made of soft wood such as pine, and stained, but in the writer's classes many boys have made these for their sisters out of black walnut or gumwood. With an oil finish the chest looks very nice, and after doll days the box can be used for other purposes, such as a receptacle for papers or keepsakes, especially if a lock is placed, as shown in the sketch.

Two sides are cut from ½" material, 6½" x 16", and two ends 6½" x 8½". These are glued and nailed together with 1¼" No. 16 brads. The top is made to fit evenly, ½" x 9½" x 16". All edges may be rounded with a file, after setting the nails, sufficiently. Fill all the nail holes with beeswax and sandpaper all parts very smooth. The bottom is cut ½" x 10" x 16½", with corners rounded, allowing a projection of ¼" all around. Attach the bottom carefully with glue and 1½" No. 17 brads.

The box should now be sawed laterally 1½" from the top. Care must be taken to saw carefully to the line. Plane the sawed edges smooth, taking pains to see that the cover and box now fit nicely.

Two handles are made 1⅛" x 1¼" x 3½" with the under side slightly hollowed out with a chisel, for a finger grip. Holes are bored for screws 1¾" from top edge and 4" from either side. Countersink these on the inside of the box and attach the handles with glue and 1" No. 6 flat-head screws. The two bottom supports are made ⅞" x 1½" x 9½" and shaped as shown on the drawing. Bore the holes 2½" from the ends and countersink, using 3/16" bit. Glue and attach to the box bottom with 1¼" No 8 flat-head screws, ¼" from ends of box.

Finish to suit the taste. If black walnut is used, apply a coat of hot linseed oil. Wipe off surplus oil and allow it



SCALE READING DEVICE.

to dry. Rub thoroughly. One or two coats of shellac may be applied over the oil if desired, rubbing to a finish with pumice stone and linseed oil.

Place 1″ plain-butt brass hinges, 2″ from box ends. Insert a lock in the front if desired.

A short length of fine chain attached to small screw eyes will allow the cover to remain open as shown in sketch.

A SCALE-READING EXERCISE

R. H. Bullock, Oshkosh, Wis.

For those who find their pupils lack the ability to read a scale, the use of this device will prove helpful. It is laid out 12″ = 1″ for the scale part, so it may be read from all parts of the room, if the room is not too large. The whole device is painted white, with divisions in black. Have ready five columns of dimensions, 20 to a column, one for each day. Have pupils number their papers from 1 to 20, allowing plenty of space, so that they may write fast. In operating the indicator, allow about five seconds between numbers. Have pupils change papers for correcting. Keep a record card to show improvement.

The scale and slider parts are of wood and the indicator is of sheet metal.

Fasten above the blackboard and provide a stick of some kind to push the indicator back and forth.

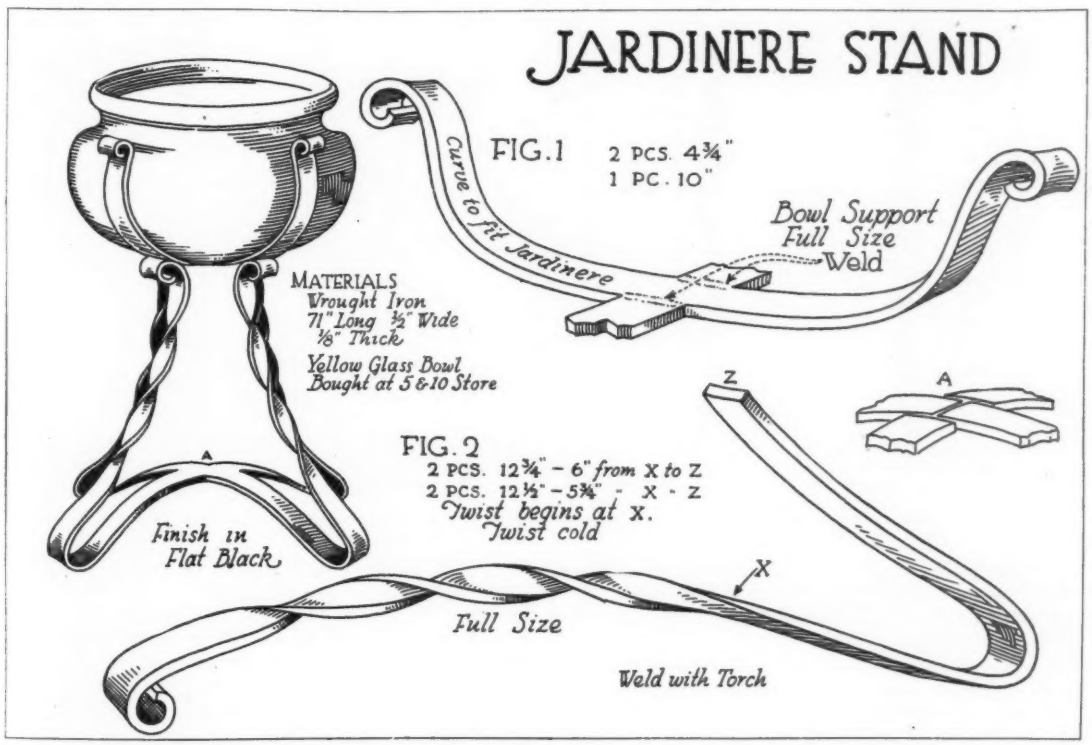
After most of the pupils get the habit of getting 100, let these drop out of the exercise for four days, but have everyone do it one day a week; when some have been excused from doing it and do not get 100, put them back on the job until they get five consecutive 100's. This will make them work harder.

SHALL WE TEACH LETTERING AS APPLIED TO PAINTING AND SHOW-CARD WRITING?

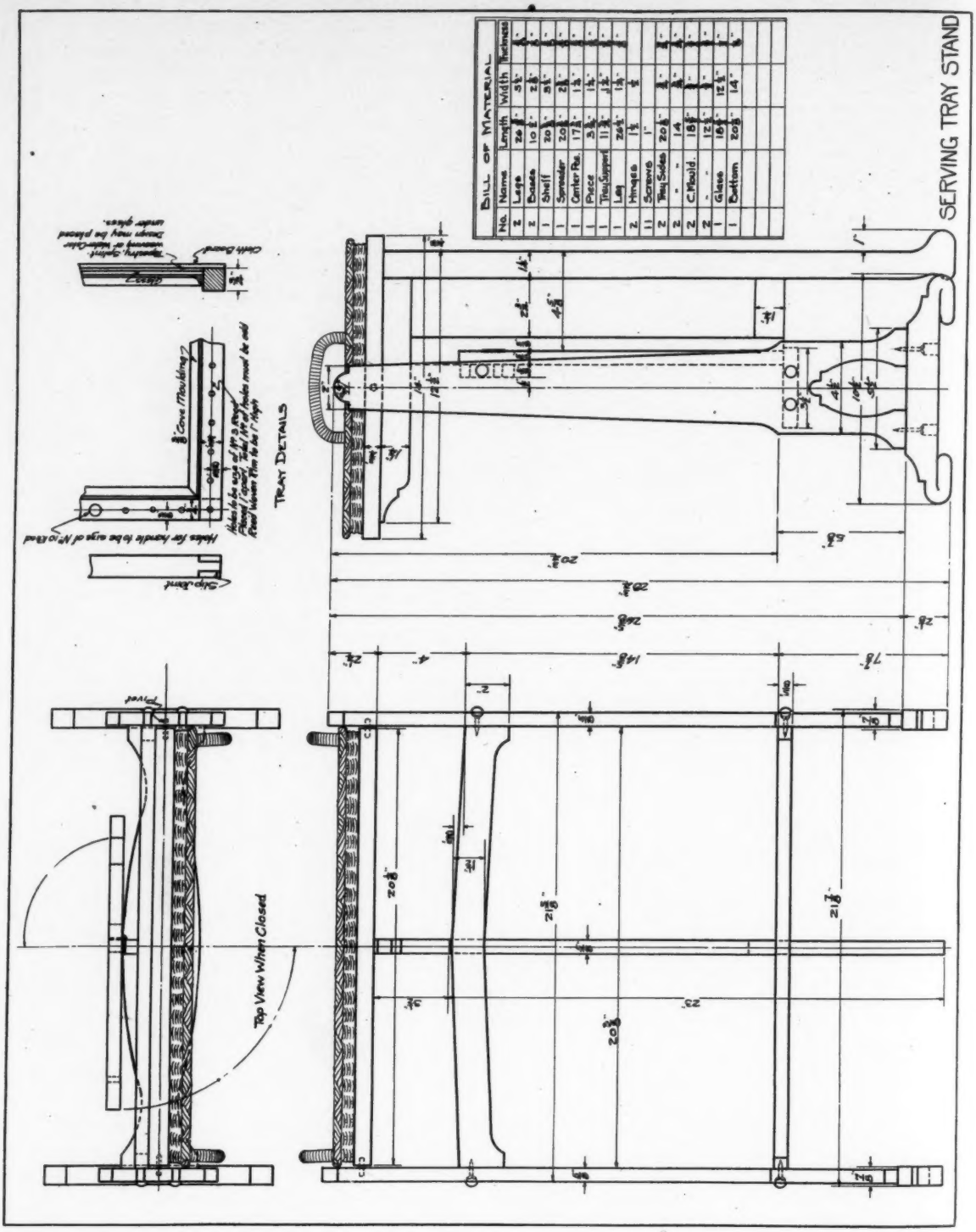
Leslie J. Miller, Supervisor of Industrial Arts, Rock Springs, Wyo.

I have often wondered whether or not a course in show-card lettering would be justified in high schools in small cities and rural communities. Traveling by automobile through eighteen states west of the Mississippi river has convinced me that such a course could be justified in any high school. The need was particularly noticeable last summer in Wyoming, Utah, Idaho, Oregon, and Washington.

Thousands of dollars are invested annually and thousands more are being invested each year in signs, show cards, and posters. Tourist camps, hotels, cafes, restaurants, lunch counters, filling stations, garages, accessory shops, confectioneries, fruit stores, and natatoriums each vie with the other by means of various colored signs to attract the traveling public. Besides all of that, we find numerous detour signs, Welcome To Our City, You Are Now Leaving ....., You Will Enter.....Next, 10 Miles To.....,



DETAILS OF JARDINIERE STAND, DESIGNED BY O. C. GREENLEAF, CARNIA, ONTARIO, CANADA.


SERVING TRAY STAND
BILL OF MATERIAL
No. Name Length Width Thickness
2 Legs 28" 3½"
2 Braces 10 2" 2⅛"
1 Shelf 20" 8½"
1 Spreader 20" 2½"
1 Center Rail 17½" 1½"
1 Piece 3½" 1½"
1 Tray Support 11¾" 1½"
1 Leg 24½" 1¼"
2 Hinges 1½" ½
11 Screws 1"
2 Tray Sides 20½" 4"
2 " " 14" 4"
2 C Mould. 18½" 1"
2 " 12½" 1"
1 Glass 16½" 12½"
1 Bottom 20½" 14"
TRAY DETAILS
Cove Moulding
Glass
Cloth Band
Slip Joint
Holes for Handle to be opp of No 2 Rail
Top View When Closed

signs advertising the prosperity of a certain county, notices of property for rent or for sale, and hundreds of signs over little wayside stands where the producer sells fruit, vegetables, and other farm produce.

Of all the lettering that attracted our attention in the five states visited last summer, I feel safe in saying that fully sixty per cent of it was done without any knowledge of, or skill in, the art of lettering. Many a beauty spot is marred by a poorly-lettered sign.

If the school recognizes this need, who is going to be asked to shoulder the responsibility? I am of the opinion that it will be the instructor of drafting who will be asked to take over the work in the smaller cities where one man cannot be employed full time for lettering.

Last year a few boys who looked forward to working in mercantile establishments after graduation asked if they might take a course in lettering instead of mechanical or architectural drafting. Since we are trying to fit the school to the com-

munity, their request was granted. We made a study of tools and materials, alphabets, unity, balance, rhythm, harmony, marginal effects, layouts, color schemes, and suitable wording. The boys made a very creditable showing.

Very recently one of our leading merchants asked me to find a boy who could do good lettering and send him to the store for an interview.

I am of the opinion that such a course would find favor with both students and patrons.

SERVING TRAY STAND

Edward F. Worst, Chicago, Ill.

This stand may be made of any cabinet wood, but oak in a dark finish or gum in a medium brown finish will perhaps be most interesting. The project is particularly useful in junior-high-school classes, because it involves a wide variety of woodworking processes, introduces a slight amount of weaving, and permits of a variety of types of finishes.

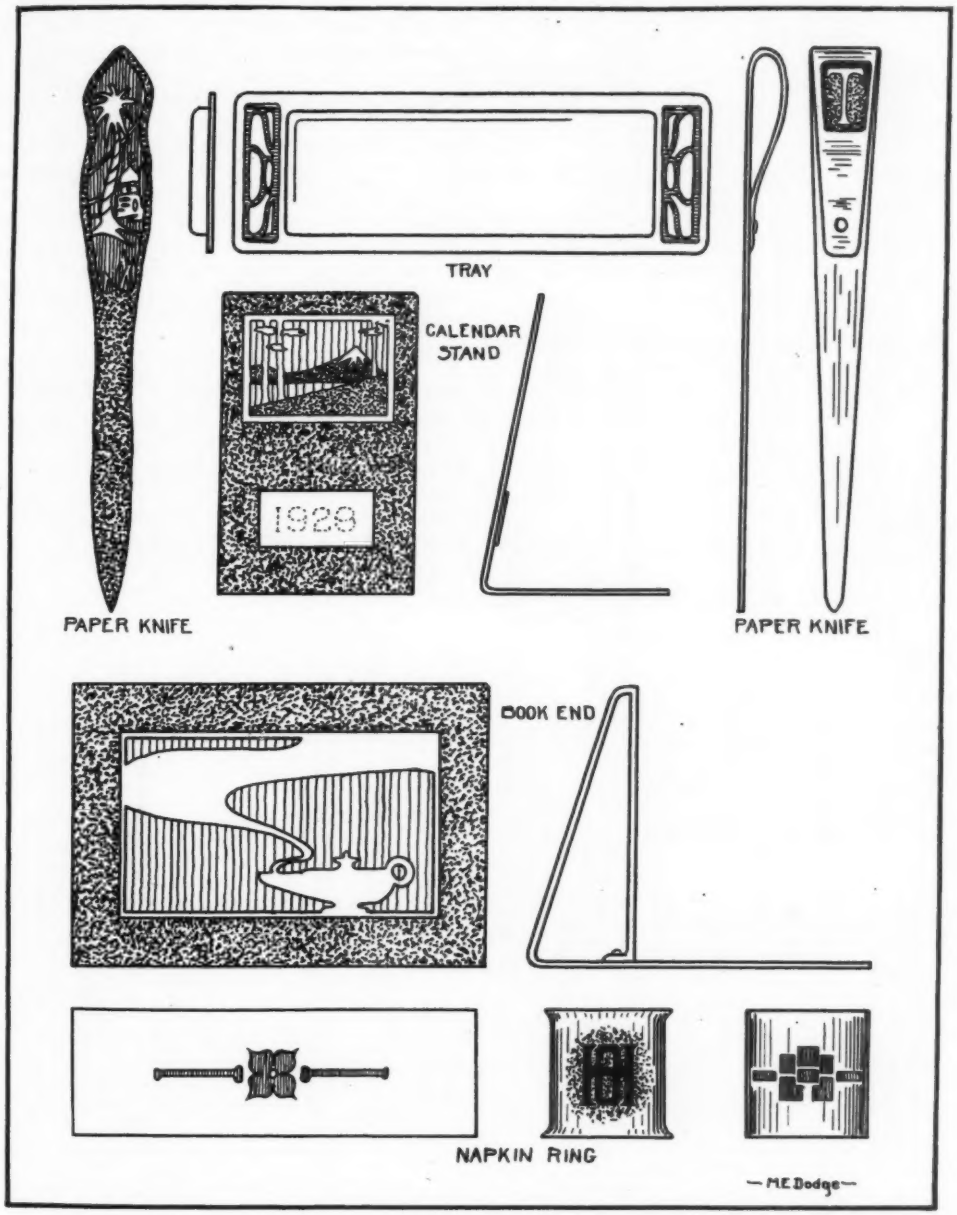
COPPER AND BRASS ETCHING

M. E. Dodge, Stanley McCormick School, Burnsville, N. C.

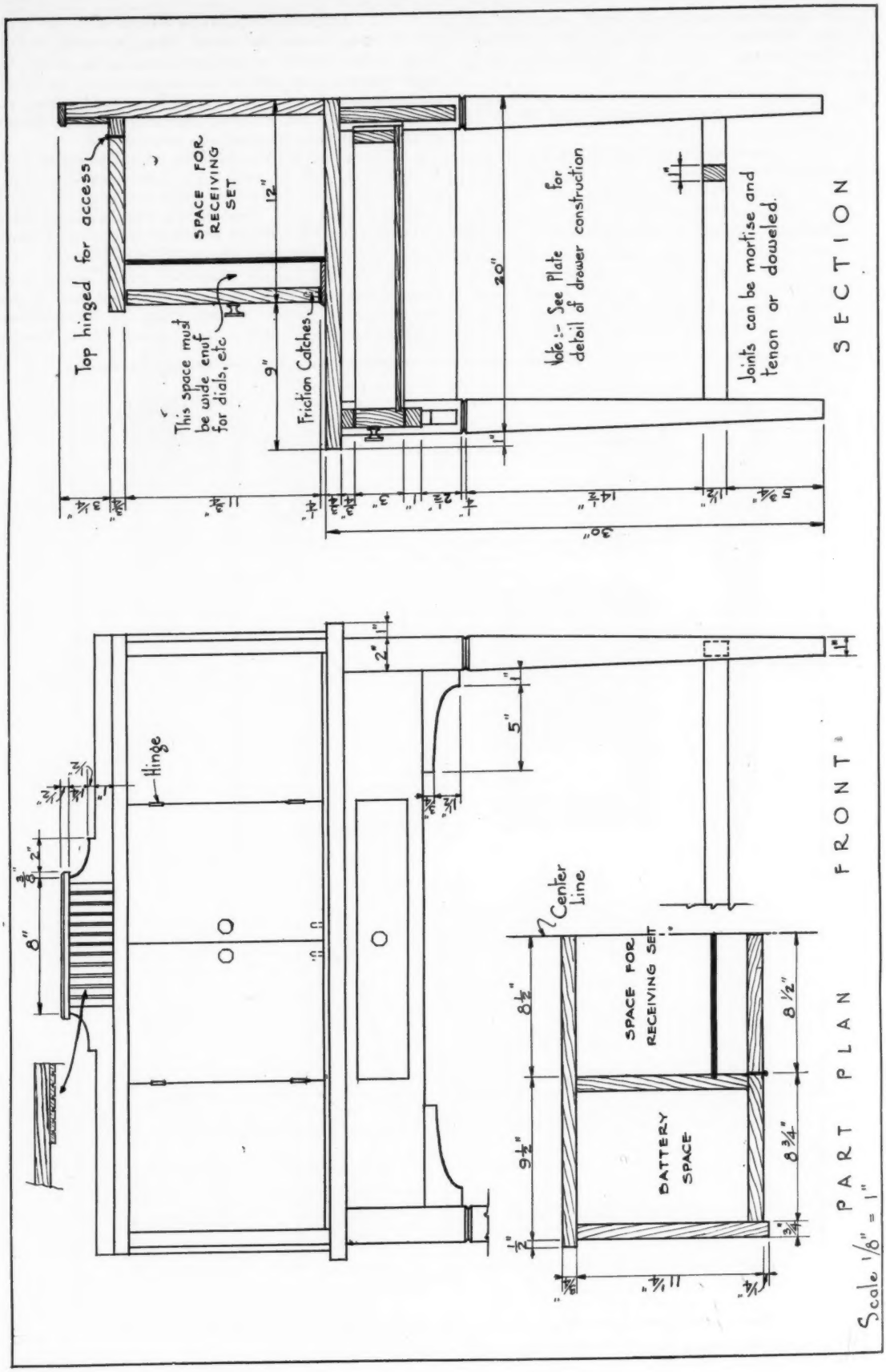
The simple scientific principles involved in the etching of copper or brass, along with the interesting results of the chemical reaction, make this work desirable for grades from the seventh up. Not only is etching interesting from the scientific standpoint but from the standpoint of art as well.

It is natural that children should be amazed when they learn of a liquid that will eat metal. It is natural that they should ask what the brown "smoke" is which rises when the copper is placed in nitric acid. They will ask what causes the liquid to turn to a beautiful greenish blue and it will be easy to teach them because of their keen interest.

The drawings suggest designs of several objects to be made of copper or brass. Twenty-gauge sheet metal is perhaps the most desirable for constructing the objects shown. It will be necessary to have at hand a small ballpein hammer,



SUGGESTIVE COPPER OR BRASS DESIGNS.



DETAILS OF RADIO CABINET NO. 4.

a pair of old shears, a few small water-color brushes, a can of asphalt paint, some concentrated nitric acid, and an earthen or glass bowl.

First of all the design to be etched should be drawn on paper and then transferred to the metal. One should decide what part of the design is to be left untouched by acid or hammer, what part is to be etched, and what part is to be hammered. The hammered surface which is often used as a background is perhaps the most artistic and pleasing of all surfaces. To obtain the hammered effect place the sheet metal on a firm, flat metal surface and beat lightly until the entire surface to be hammered has been touched.

Next, paint the surface of the object with asphalt paint, with the exception of the part which is to be etched. Where there are lines to be etched, it is best to scratch them in with a stiff pen, or pointed instrument, when the paint has dried for 24 hours. It is well to remember that a line will etch nearly twice as wide as the original scratch.

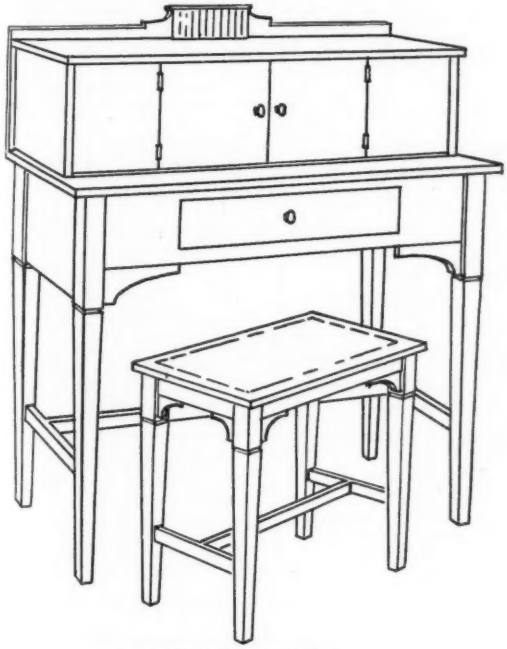
When the paint has dried for 24 hours or more, the piece is ready to be placed in the acid. Care should be taken to instruct the children of the danger in case the acid is spattered or spilled on their bodies or clothing. Enough water is placed in the earthen bowl to nearly cover the metal. Add nitric acid until the liquid is strong enough to cause bubbles to rise from the bare metal.

Remove the metal when the acid has eaten to the desired depth and wash with water. Remove the asphalt paint with kerosene, gasoline, or turpentine. Polish the surface with fine steel wool. A beautiful polychrome finish may be obtained by holding the copper over red-hot coals. Whatever the finish may be apply a coat of banana oil to keep the color from changing.

RADIO CABINET NO. 4

Gladstone Califf and Arthur Christensen

It is intended that the loud speaker for this cabinet should be a separate unit placed on top of the cabinet, but if desired, one of the battery spaces at either end may be used for the loud speaker and grilles constructed in the panels at the sides of the doors. If more space is needed for B batteries, shelves can be built in the space at the sides of the drawer. These would be accessible from below.



RADIO CABINET NO. 4.

The grooves in the panel at the top can be made with a saw and should be carefully cut and sanded.

The stool shown in the perspective would add to the attractiveness of the cabinet as an article of furniture. It should be 12"x20"x18" high and would be especially attractive with a cane seat.

4 pc.	2 x 2 x 29¼	Legs
2 pc.	1 x 1½ x 19	Stretcher
1 pc.	1 x 1½ x 34	Stretcher
1 pc.	¾ x 4¾ x 34	Apron
1 pc.	¾ x 7 x 34	Apron
2 pc.	¾ x 7 x 18	Apron
2 pc.	⅞ x 2¼ x 6	Braces
1 pc.	¾ x 21 x 38	Top
1 pc.	¾ x 3 x 17	Drawer Front
1 pc.	½ x 2½ x 15½	Drawer Back
2 pc.	¾ x 3 x 18	Drawer Sides
1 pc.	16 x 17	Beaver Board Bottom
1 pc.	¾ x 16 x 38	Back
2 pc.	¾ x 11½ x 12	Ends
2 pc.	¾ x 8¾ x 12	Front
2 pc.	¾ x 8½ x 11¾	Doors
2 pc.	¾ x 10½ x 11¾	Division
1 pc.	¼ x 3 x 34½	Door Sill
1 pc.	¾ x 1½ x 38	Top Hinge Strip
1 pc.	¾ x 10 x 38	Top
1 pc.	½ x 1¼ x 8¾	Caps
1 pc.	¼ x 2¾ x 7½	Ornament
2 pr.	1 x 1½	Hinges

3 Knobs
2 Friction Catches
Screws, nails, etc.

Note: Finished sizes are given except length, in which allowance has been made for tenons.

A PROCESS SHEET IN UPHOLSTERING

H. Bast, Sheboygan, Wis.

Upholstering as a vocational subject lends itself particularly well to the use of job sheets; or I should rather say, the job sheet is most helpful in teaching the elements of upholstering. The following process sheet is one of a type which has been found entirely successful:

Springing

Springs are a source of comfort, and must be tied to assure comfort as well as to be rigid. The life of the furniture depends on the condition of springs, and that depends chiefly upon the manner in which they are tied. Care must be taken to see that the springs stand straight and do not slip on twines when tied down.

Tools and Equipment: Hammer, shears, straight and curved needles.

Materials: Springs, spring-twine, stitching-twine, tacks, burlap.

Procedure:

1. Locate position of springs.
   (a) This will be determined by the number of springs to be put in the job.

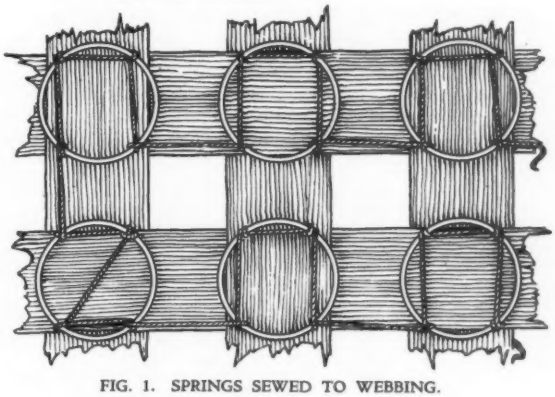


FIG. 1. SPRINGS SEWED TO WEBBING.

2. Sew springs to webbing.
   (a) Four stitches to each spring.
   Note: The stitches should be so planned that the last stitch taken will be at the nearest point of the next spring.
3. Measure length of spring twine.
   (a) Hold twine over springs and allow 2" for each spring for knots.

4. Tying springs to height.
   (a) Tack one end of twine to frame in line with each row of springs.

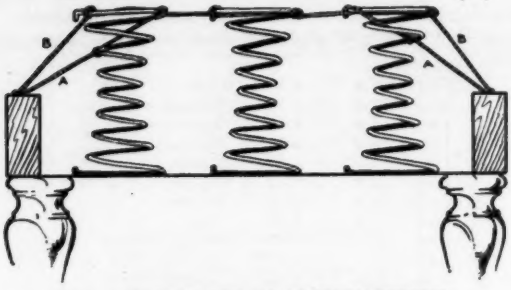


FIG. 2. SPRINGS TIED TO UNIFORM HEIGHT.

   (b) Loop twine over top ring of each spring and pull down to desired height.
   (c) Follow with another twine, knotting over each loop.
5. Cross-tie springs.
   (a) After all springs are tied to desired height, add cross-twines between springs, knotting at all intersections and on each spring.

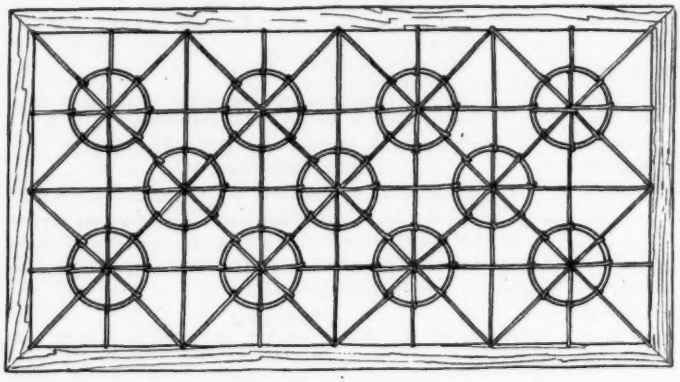


FIG. 3. SPRINGS CROSS TIED.

FIG. 4. METHOD OF SEWING BURLAP TO SPRINGS.

6. Burlap over springs.
   (a) Tack all around.
   (b) Sew burlap to springs.
   (c) Three stitches to each spring.
   Note: The stitches should be so planned that the last stitch taken will be nearest to the next spring.

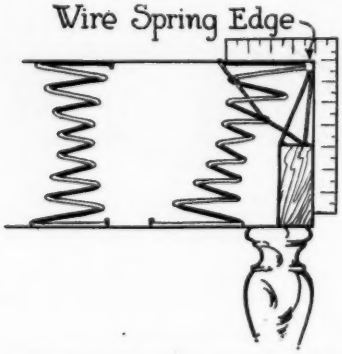


FIG. 5. TESTING WIRE SPRING EDGE WITH SQUARE.

7. Making spring edge.
   (a) Bend top of spring so spring extends over front even with outside of frame.
   (b) Fasten wire along spring-edge by means of stitching twine or wire clasps.

TURNING THE SPLIT PATTERN
A Job Sheet for Patternmaking
By C. W. Illingworth, Racine, Wis.

USE—The split pattern is one which is made in two halves and held together by means of dowel pins.

Split patterns are usually easier to mold than solid patterns because the flat joint or surface of the drag half may be laid flat on a board. Fig. 1.

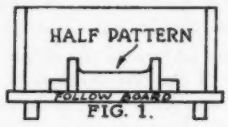


FIG. 1.

PREPARATION FOR USE OF TURNED SPLIT JOB—1. Get out two pieces of stock 1¼″ longer on each end than the total length of the pattern, plus core prints. This is to allow for screws.

2. The width of each piece should be ¼″ more than the pattern will be. This allows for turning off.

3. The thickness of each piece should be ⅛″ more; ⅛″ on each piece makes a total of ¼″.

4. Surface both pieces on one side so that you have a good joint when they are put together.

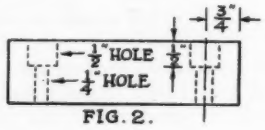


FIG. 2.

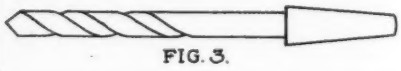


FIG. 3.

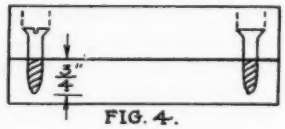


FIG. 4.

5. Since the two halves are held together by two screws, it is necessary to bore holes, first for the screw head to set below the surface and then for the shank of the screw.
   (a) Bore a ½″ hole ¾″ from each end of one piece and about ½″ deep.
   (b) Then bore a ¼″ hole through the balance of the stock. See Fig. 2. Use a ¼″ twist drill. Fig. 3.

5. Screw the two halves together. The screws should extend about ¾″ into the piece without the holes. Fig. 4.

7. Saw off both ends so they are even.

8. Locate the center on each end. Measure on the joint line half way from each end. Fig. 5. Fig. 6 shows the proper method of finding the center of a *solid* piece but *not of a split job*.

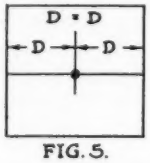


FIG. 5.

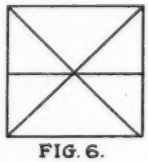


FIG. 6.

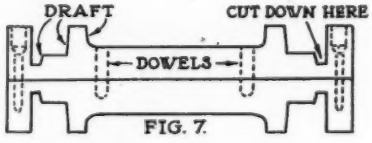


FIG. 7.

9. Enlarge the center mark with an awl or pair of dividers. This makes it easier to get the lathe centers in the right place. Be careful not to work the hole away from the center which should be exactly on the joint to make an accurate job.

10. Proceed to turn as with a solid job. Care must be taken not to turn down too close to the screws.

11. When you have finished and before you have taken the screws out, bore the dowel-pin holes. Fig. 7.

GUARDING THE MACHINERY IN SCHOOL SHOPS

G. E. Irons, Bureau of Standards, Board of Education, Cleveland, O.

(Concluded from March.)

Sec. VI. Shafts, Gears, Set-Screws, Keys, etc.

Section 13 of the general safety code reads as follows:

"*All Revolving Shafting* three (3) inches or less in diameter, located six (6) feet or less above the floor or platform and exposed to contact, not an integral part of the machine, shall be enclosed or otherwise guarded. Standard railing may be used."

This requirement covers a major hazard unless the exposed shafting is revolving very slowly indeed. Even perfectly smooth shafting, if a little greasy, is capable of catching and winding certain articles of clothing and causing serious results. It is recommended that every revolving shaft coming within the requirements of Section 13 be considered a major hazard and guarded if it is at all possible and practicable to do so, and that this guarding be done to a height of 7' rather than the 6' required.

Revolving set screws, keys, clutches, or any other projecting parts which revolve and are exposed to contact are major hazards, if below seven feet from the floor, or otherwise accessible to workers.

Shafts and countershafts above a height of 7' from the floor shall be considered minor hazards, except where such shafts pass over, or are in close proximity to balconies and platforms used by students or instructors for storage or other purposes. In the latter case, full precautions shall be taken to safe-guard all pulleys, shafting, keys, set screws, clutches, and belting. (See also Sec. No. V, guarding of belts.)

All exposed gearing shall be guarded, regardless of its location. A band guard around gears is not sufficient nor acceptable; it must have side flanges which completely cover the gear teeth at all points. Wherever possible the entire gear shall be covered, especially if it has spokes.

Any and all exposed gearing constitutes a grave major hazard.

In purchasing new machinery, specifications shall require complete guarding of all moving, revolving, or reciprocating parts, in accordance with these standards and the State Industrial Codes. No machinery not so guarded, to the satisfaction of the Commissioner of Housing and the Supervisor of Vocational and Practical-Arts Education, shall be accepted or paid for until adequate guards have been applied by the manufacturer of said machinery.

Sec. VII. Machinery Control

The code requirements in this respect (Section 15) shall be followed in all cases, both existing and future, excepting paragraph "C" regarding belt shifters, concerning which more definite requirements are herein set forth.

It is *not* necessary, however, to provide room control, wall control for individual machines, and switch control at the machine itself as has been done in certain woodworking shops. The room control (panel board with switch for each machine) and an individual switch at each machine are sufficient for all purposes.

All electrically driven machines purchased hereafter shall be provided with individual control switches at each machine, switches to be operated by push buttons—with the "start" button guarded to prevent accidental starting. If the voltage is high enough to prevent direct control by heavy-duty push buttons, magnetic control switches shall be provided with push buttons to operate same.

Where individual switches are required for existing machines, or when new machinery is purchased, the specifications shall include a definite requirement as to an approximate location of the switch on each machine in the position most easily reached by the operator when working at the machine.

Snap switches shall not be acceptable because their operation may easily be fumbled in an emergency.

Sec. VIII. Guards for Special Purposes

(A) Woodworking Machinery

(1) *Variety-Saw Bench.* The guard must have the following characteristics to make it satisfactory for the variety of uses required in a school shop:

(a) It must be of such construction that the hood over the saw is rigidly fixed against horizontal motion which would permit saw to be fouled by hood. Lack of such rigidity is perhaps the most common and most damaging defect of the saw guards now in service.

(b) It must permit the wood to pass under it easily, but should rest directly on the wood rather than remain some distance above it. A counter-weighted and balanced guard fulfills this requirement.

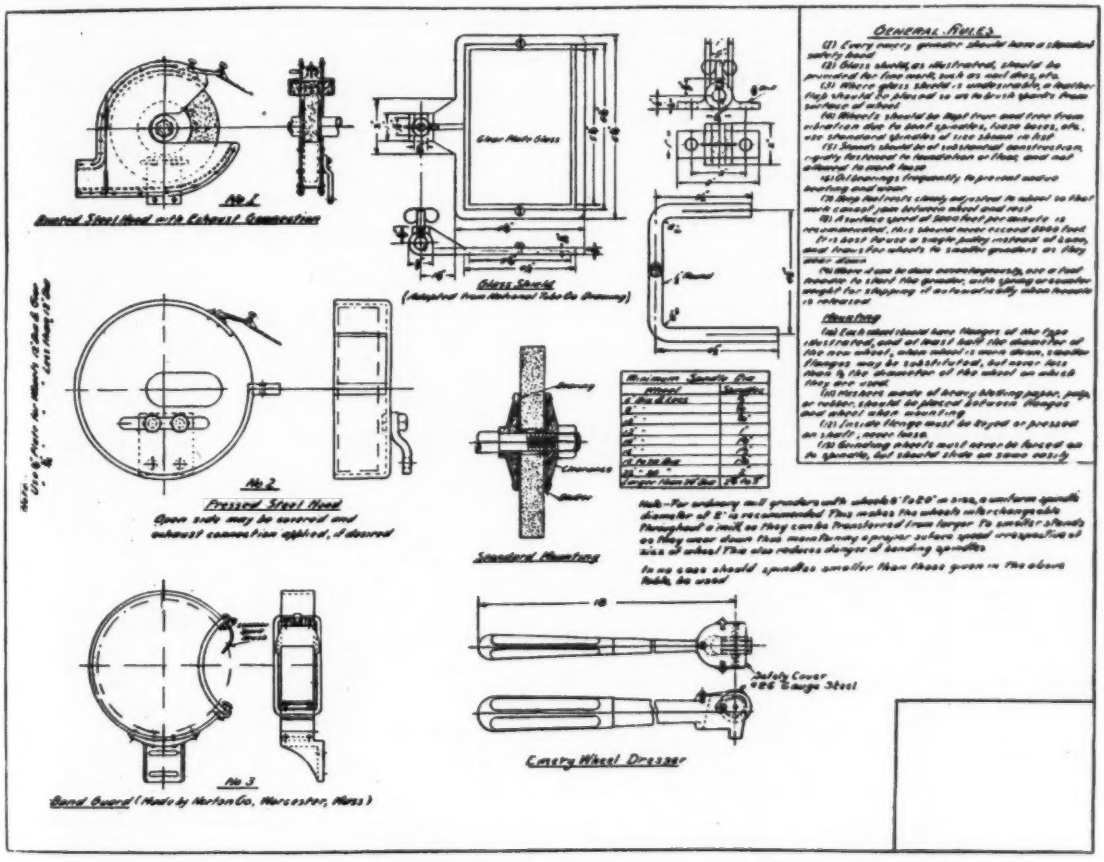
(c) It must prevent kicking back of the wood by the saw, or "riding" the saw.

(d) It must not be so wide nor have such projecting parts as to hinder the sawing of narrow widths.

(e) It must permit of being thrown completely out of the way for special work, such as tenoning edges of boards, or dadoing slots and grooves.

(f) It must be rigidly supported either from the floor or machine *near the rear* of the table, or from the ceiling.

(g) It must permit tilting of the table.



STANDARD MOUNTING AND SAFETY PROVISIONS FOR EMERY WHEELS AND GRINDERS.

(h) A splitter is desirable for ripping purposes, but said splitter must be capable of being easily thrown out of action.

(1) An unguarded circular saw is a major hazard, especially if it is being used by students. Special push sticks for dadoing should be on hand in each shop.

(2) *Band Saw.* Both upper and lower wheels must be completely enclosed with wire-mesh screen and sheet metal, in a manner similar to that shown in J. A. Fay & Egan catalog No. 117, page 11.

The uprunning side of saw blade shall be completely protected between the wheels.

A sliding guard must be provided above the saw guide. This protector must extend to the rear sufficiently to prevent access to the saw blade on the side. This sliding guard shall be permanently attached to the guide bar. Guards which merely rest upon the guide shall not be acceptable for the reason that they are too often left up, out of action.

An Automatic Saw Guide shall be furnished on every new band saw purchased, and shall be substituted for other saw guides now in use as rapidly as budget funds may permit. In addition to its automatic feature, the construction of this guide is such as to help to prevent contact with the saw blade.

The arbor nuts of the band saw wheels shall be covered. (See J. A. Fay & Egan Co. catalog No. 117, page 11.)

The belt mechanism in rear of all new saws shall be guarded with standard belt guards as herein specified. On existing machines in the school system having this mechanism guarded with a different, but safe, type of guard, such guards shall continue in service until replacement is required, when they shall be replaced by guards of standard construction.

Guards which do not include the above mentioned features shall not be accepted on new machines, but on machines already in use, only the following improvements shall be made:

(a) If the top of the upper wheel is not already completely enclosed, a strip of band iron, 2½″ x $\frac{3}{16}$″, shall enclose the top of the upper saw wheel to obviate existing hazard, should a saw break.

(b) The sliding guards above guides shall be improved as required, to make them workable and safe in every instance. In most instances this will be accomplished by fastening existing sliding guards to the guide bars just above the guides.

(c) The lower arbor nut, only, shall be boxed in with a sheet-metal box attached to the existing wire-mesh guard.

These are major hazards, excepting item "C" which may be considered a minor hazard.

(3) *Jointer.* The guard on the working side of the gauge shall be of the eccentric wing type, actuated either by an adjustable spring or by a weight (Flohr, American, or J. A. Fay & Egan type). All jointers shall have safety cylinder heads. That part of the jointer head which is behind the fence or gauge shall be guarded by a plate of sheet iron attached to the gauge in such a manner as to keep the knives covered at all times. Major hazards.

(4) *Wood Lathes* (Belt Driven). These lathes are light and the belts usually only 1″ to 1¼″ wide. Belt shifters on the cone pulleys, or guards around the belts are required by code, but this may be considered a minor hazard on existing belt driven lathes, of which there are only a few in the school system.

(5) *Surface Planer.* The special hazard in this machine lies in the revolving knives which cannot be covered entirely, unless an exhaust hood is used to carry away shavings, the exhaust hood also serving to completely enclose the knives. This machine should in all cases be protected by an exhaust hood connected to an adequate exhaust system, and such steps as the budget may permit shall be taken to carry out this protection. Guarding of belting, pulleys, gearing, etc., shall be applied as specified.

(6) *Belt Sander.* The driving pulley and driven pulley shall be fully protected by standard guards which shall also enclose as far as may be practicable the small idler pulleys.

(7) *Abrasive Mats.* The working area of floor around circular saws, band saws, jointers, mortisers and planers shall be treated to prevent slipping (sawdust makes wood floors become very slippery). Such treatment may consist either in applying to the area a coating of a mixture of glue and sand, or in cementing in place a corrugated rubber mat. If rubber mat is used, it must not be merely tacked down, because worn edges will then become frayed and loose, and will introduce a tripping hazard. If the former method is used, care must be taken to secure a waterproof or nearly waterproof glue, and the treatment must be renewed at intervals of two or three years.

In new buildings this need may be met by installing an insert of concrete or "Mastic" flooring around the machine, particularly on the working side. The latter material is reported satisfactory by the American Steel and Wire Company.

(B) Sheet-Metal-Shop Equipment

(1) *Forming Rollers* (Hand Power). Gears at end shall have sheet-metal guards.

(2) *Squaring Shear* (Foot Power). This machine shall be equipped in all cases with an angle-iron finger guard in front of the knife. This finger guard shall allow sheet metal to pass under it, but not fingers. It shall be located $\frac{3}{16}$″ to ¼″ away from the knife, and not more than $\frac{1}{16}$″ up from the table. The machine shall be so located that pupils will not ordinarily have reason to approach the rear of knife.

(3) *Combined Punch and Shear.* A finger guard is required in front of the knife. This guard must be adjustable to take stock up to the maximum capacity of the machine.

(4) *Burring Machines, Bar-Folding Machines, Turning Machines,* and *Wiring Machines* require no guarding. These are all hand-power machines.

(5) *Beading Machine* has some small gears to be guarded (hand power).

(6) *Bench Drill Press.* Contact with driving belt or pulleys to be prevented by sheet-metal guards.

Cone pulleys need not be guarded.

(7) *Demonstration Lathe.* Motor pulley and driving belt shall be guarded.

Nos. 2, 6, and 7 are major hazards; all others minor.

(C) Print-Shop Equipment

(1) *Poco Proof Press.* Guards shall be provided to house the rack and gear on one end of cylinder and to prevent fingers being pinched under the cylinder at the other end. These should be furnished by the manufacturer on new machines, and fabricated from sheet metal for existing Poco Presses in the system.

Minor hazard (hand-power machine).

(2) *Printing Presses* (10″x15″ or 12″x18″). Flywheel openings shall be closed; friction drives shall be housed with sheet metal; extended shaft ends housed with sheet metal; Chandler & Price platen guards provided on each machine; and all gearing housed in accordance with code requirements. On older machines which are belt driven on the main flywheel, the belt shall be spliced or laced with rawhide. It is not practicable to cover this flywheel because it must be turned by hand at times. The belt shall be guarded around motor pulley, however, and when practicable, a wire-mesh screen or a railing shall prevent accidental entanglement between the belt and the large flywheel.

When the machine is driven by an auxiliary pulley on the extended shaft, the entire belt drive shall be guarded.

These are all major hazards.

(3) *Paper Cutter.* A small device is being perfected by the Chandler & Price Co., which will lock both the paper binder and knife in the "down" position, making it impossible to operate the machine. Such devices shall be furnished for all paper cutters, and chained to the machines. A small padlock is required for each device to prevent unauthorized use of the machine outside of school hours to cut metal objects.

In legitimate operation of the machine, the lever construction automatically prevents accidents. Therefore, this may be considered a minor hazard.

(D) Machine-Shop Equipment

(1) *Lathes.* On metal-working lathes having drive belts 2″ or less in width, mechanical belt shifters shall be provided in lieu of belt guards. When these belt shifters are so used without belt guards, no metal fastenings are permissible in splicing belts; they must be either cemented, or laced with rawhide.

On metal-working lathes having drive belts wider than 2″, standard belt guards shall be provided in addition to belt shifters, unless it can be shown to the satisfaction of the Director of Schools that such belt guards will materially interfere with the operation of the machines to be guarded.

The general requirements as to gears, shafting, etc., shall be observed.

In all cases where the operation of the machine will permit, and specifically for all speed lathes operating above 1500 r.p.m. and for engine lathes having chucks larger than 10″ in diameter, sheet-metal strap guards shall be provided around lathe chucks (or face plates); said guards shall have wired or rolled edges, shall be constructed of No. 14 gauge, or heavier sheet metal, and shall be hinged in sections to permit their being thrown back. See Standard Detail No. 702.

All existing lathe dogs which have protruding square-head set screws shall have these set screws replaced by countersunk set screws, as required by code, and a sufficient number of wrenches for same shall be furnished for each shop as may be specified. In case the countersunk set screws prove unsatisfactory for certain work, safety lathe dogs of the type used by the American Steel and Wire Co. shall be used. Drawings and specifications for such lathe dogs will be secured by the Bureau of Standards upon request.

All of these requirements are of major importance.

When new lathe dogs are purchased, they shall be of the safety variety, having countersunk set screws or of the American Steel and Wire type.

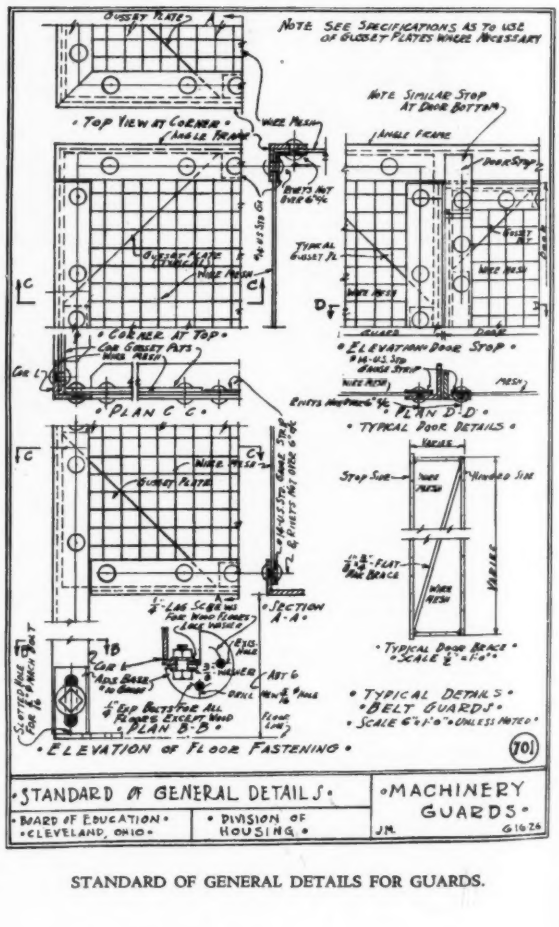
The use of chip guards on lathes is recommended. These guards can be easily and inexpensively prepared in the school shops, using substantial wire mesh as the protecting material: (a piece of wire mesh 8″ to 12″ square with hole near one end to go over tool post, makes a satisfactory chip guard on a lathe).

(2) *Grinding Wheels.* Grinding wheels shall be completely enclosed except for the working surface in front of the wheel. The guard shall not intertere with the adjustment of work rest, however. The guard shall be constructed in such manner, approved by the Commissioner of Housing, as shall make it conveniently possible to remove or open the guard in order to change wheels. The guard illustrated on page 94 of catalog E of Safety Equipment Service Co. (Cleveland) is satisfactory.

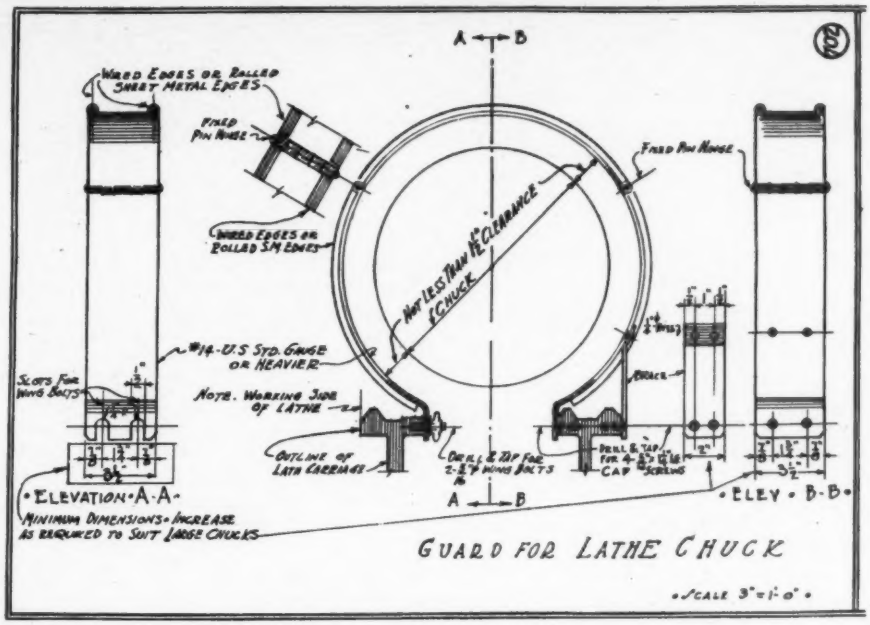
In many cases guards are in use which enclose the circumference of the wheel but not the sides nor the arbor nut. In such cases an extension to existing guard shall be provided to enclose arbor nuts.

The guard must be substantially constructed, of steel strong enough to retain pieces should wheel break.

The flanges for grinding wheels shall meet the requirements set forth in the Ohio Code of Specific Requirements covering polishing and grinding machines.



STANDARD OF GENERAL DETAILS FOR GUARDS.


A
B
WIRED EDGES OR ROLLED SHEET METAL EDGES
FIXED PIN HINGE
WIRED EDGES OR ROLLED SM EDGES
NOT LESS THAN ½" CLEARANCE
#14 U.S STD. GAUGE OR HEAVIER
NOTE. WORKING SIDE OF LATHE
SLOTS FOR WING BOLTS
OUTLINE OF LATH CHERMAS
DRILL & TAP FOR 2-¼" WING BOLTS
DRILL & TAP FOR 4-
CAP SCREWS
BRACE
ELEVATION A-A
MINIMUM DIMENSIONS INCREASE AS REQUIRED TO SUIT LARGE CHUCKS
ELEV B-B
GUARD FOR LATHE CHUCK
SCALE 3"=1'-0"

An eye shield shall be provided for every grinding wheel, said shield to be Hoyman, or equal. (Standard Safety Equipment Co., 410 N. Michigan Blvd., Chicago, Ill.).

For further suggestions as to proper mounting, guarding and operation of grinding wheels, see the accompanying illustration of the Standard Provisions of the American Steel and Wire Co. for Emery Wheels and Grinders.

(3) *Planers and Shapers.* There shall be at least 18" clearance at the end of the stroke of planer beds or shaper rams to prevent persons from being jammed against walls, columns, or other machines. If less clearance exists, safety railings shall be provided to prevent passage through the dangerous space behind such machines.

Openings under planer beds shall be closed with sheet metal, and the lower openings in rail housings of planers shall be closed, unless the position of belts and belt guards is such as to prevent anyone getting a hand or an arm through such openings.

The usual requirements as to belts, shafting, etc., shall be observed with due regard to the operating requirements of the machines.

Chip guards should be used on shapers, as on lathes, especially when machining brittle metals.

All of these requirements are of major importance, excepting the chip guards, which are, however, so inexpensive that their use when necessary need not be delayed by cost considerations.

(4) *Milling Machines.* Although the code does not require it, the best industrial practice is to place hinged belt guards in front and rear of the cone pulleys in addition to the belt shifters. Consideration should be given by the shop instructors to the possibility and necessity of guarding the milling cutters as is frequently done in industrial shops.

(5) *Belt Hooks.* Consideration should be given to the provisions of permanent belt hooks to carry idle belts when they are thrown off the pulleys, wherever it is found necessary to have such idle belts. At present, belts are occasionally allowed to ride the shafts, which is considered bad practice.

Sec. IX. In Final

No specific safety requirements are defined for domestic-science rooms, jewelry shops, pottery rooms, chemistry and physical laboratories, or other special-activity rooms, although certain small machines may be found in any or all of these. It is the intent of these standards that the general principles laid down shall apply with equal force to all machinery now operating, or to be operated, in the public schools (including the operating equipment in charge of the building custodians) or in the workshops and garages of the maintenance divisions.

If situations exist to which no part of the general or specific state requirements, nor these standards, apply, such situations shall be referred to the Bureau of Standards for further study.

NEW BOOKS

Model Ship Making

Vol. II. E. Armitage McCann. Cloth, 150 pages. Price, $2.50. N. W. Henley Publishing Company, New York, N. Y.

The romance of the American clipper has been sung by poets and novelists, and its beauty has been recorded by painters and illustrators. The present writer seeks to perpetuate its charm by complete directions for reproducing one of the most famous of the clippers as a decorative model.

It has always appeared to the reviewer that models of Spanish caravels, Viking ships, and similar ancient craft lack authenticity and accuracy, and fail to satisfy the model builder who seeks to faithfully approximate the original ships in scale and in details of gear, sail, and hull. Just here ships like the present, "The Sovereign of the Seas" are especially good material, because they combine the highest degree of beauty in outline and proportion with the possibility of accurate and truthful work. Best of all the average, skillful amateur may attempt such a ship with fair promise of success and with a minimum of expense.

The present book is quite adequate in plans and descriptions, amply clear and complete for the amateur, and quite well illustrated. A simplified rigging plan is provided for the novice builder, and a complete plan for the advanced, amateur model builder. The book and the ship will satisfy the most ambitious ship-model enthusiast.

Laboratory Manual for Automotive Electricity

By Wm. R. Varner and Fred C. Smith. Cloth, 190 pages. Illustrated. Price, $2, net. John Wiley & Sons, New York City.

The authors of this book proceed upon the thought that practical experience in the laboratory is essential to a thorough understanding of the fundamentals of electricity as applied to the automobile. Hence they begin by introducing the student to electrical terms and measurements. Magnetism and electromagnetism, electric-motor principles, counter-electromotive forces are thoroughly explained.

The textbook is chapterized into a series of experiments, twenty-eight in number, covering every phase of the electrical equipment which gos into an automotive service. Every test is equipped with illuminating illustrations, and followed by a set of questions.

My Lifework: The Printing Trades—The Composing Room, the Pressroom, the Lithographing Room, and the Bindery.

My Lifework: The Automobile Trades.

My Lifework: The Stationary Engineer.

These pamphlets represent a study of occupations in Milwaukee and are similar to other studies previously issued. The material was prepared by Mr. Harry S. Belman, under the direction of Mr. R. H. Rodgers, and is issued by the Milwaukee Vocational School, Milwaukee, Wis.

The pamphlet on the Composing Room discusses the invention of printing, its importance as an industry, divisions of the industry, the operations to be performed, the tools and materials used, education and training required, working conditions, and promotional possibilities.

The pamphlet on the Pressroom discusses the development of the printing press, types of pressrooms and presses, operations to be performed, education and training required, working conditions, and promotional possibilities.

In the pamphlet on Lithography there is discussed the development of lithography, the organization of the plant, the operations to be performed, tools and materials to be used, education and training, working conditions, and promotional possibilities.

In the pamphlet on the Bindery there is discussed the importance of the work, divisions and operations, training and education, working conditions, and promotional possibilities.

In the pamphlet on Automobile Trades there is discussed the place of employment, the future of the occupation, the operations to be performed, tools and materials to be used, working conditions, and promotional possibilities.

The pamphlet on the Stationary Engineer discusses the importance of the occupation, tools and equipment to be used, the operations to be performed, training and education required, and promotional possibilities.

VOCATIONAL EDUCATION SOCIETY OF BOSTON

The Vocational Education Society of Boston held its regular luncheon and business meeting Saturday, February 12, at the Hotel Westminster, Copley Square. Mr. Henry A. Norris, educational adviser for the Boston Elevated Railway Company, was introduced as the speaker by President Baker.

Mr. Norris, representing a type of educational work which is comparatively new and little known, brought a message of much interest. He was able to correct a rather common opinion that the courses offered by a "company school" are necessarily of a strictly vocational type. This is not true of the Boston Elevated's educational program. Its most recent development, a series of three reading courses, deals with the subjects of literature, popular science, and social science. These courses are the outgrowth of a suggestion made last year by President D. L. Marsh of Boston University, to the effect that fifteen minutes of systematic reading a day would give anyone a valuable education in a few years. The Elevated officials asked Dr. Marsh to organize such a course; and under the direction of the university's department of extension, it is now being given to the railway's employees.

Obviously the whole scheme of education for employees is not a selfish one on the part of the company. The Elevated, in common with many other large employers the country over, stated Mr. Norris, has felt that it owes something to its employees in the matter of education, in which so many of them had been deprived of early opportunities. Except to the extent that a mentally alert employee does better work, the plan from the beginning was one that sought the benefit of the individual rather than of the company.

The program started five years ago, when a course on applied electricity was given to two hundred men under the auspices of the University Extension Division of the Massachusetts State Department of Education. This was followed the next year by courses in advanced electricity, and public-utility management. The interest as demonstrated by enrollments was so great that the permanency of the program was assured. It has grown steadily each year. New courses have been tried with utmost freedom; some have been dropped while others have become fixtures. The present program, it is felt, is still a tentative one which is subject to change from year to year.

The courses being offered in the present season (in addition to the reading courses already mentioned) are foreman conferences, first year; foreman conferences, second year; current events; public speaking; business English; interdepartmental accounts; automotive maintenance; electric-railway law; departmental group conferences.

Emphasizing the fact that this program is not in any formal sense a *school*, Mr. Norris pointed out that the facilities of other institutions and agencies are freely availed of, and in general the railway originates new courses only when there appear to be none of the exact nature for which there is a demand. Employees are not urged to enroll. If, on the other hand, an employee wishes to take a course not offered through the company, but obtainable in one of Boston's colleges or elsewhere, the Elevated will reimburse the employee for half the cost of the course, when he presents evidence of having satisfactorily completed it. This means that the many employees studying in law schools, colleges, and technical schools, can benefit from the Elevated's educational policy, as well as those who are enrolled in the courses specifically offered by the railroad.

Mr. Norris spoke briefly of the magnitude of the street railways —the third industry in the country in point of investment. Several street-railway systems, he said, now have educational programs. From his own experience as an educator, Mr. Norris spoke in highest commendation of both the attitude and the ability of the men enrolled in the courses. The maturity of judgment, the earnestness of purpose, and even the stored data furnished by the men's own minds, can not be duplicated in college classes.

At the conclusion of his remarks, Mr. Norris answered a number of questions from the floor. President Baker described briefly the arrangements which two large industrial plants have with Boston Trade School, under which they send their apprentices, on company time, to the school for instruction. Other large companies are becoming interested in the plan, he stated.

Assistant Superintendent John C. Brodhead told of a plan worked out by the Schrafft Company and the Boston Continuation School, for girls employed by the concern. These girls spend every other week at the continuation school, instead of the four hours a week required by law in the case of minors under sixteen. Plans are now under way, at the request of this company, for extending a similar opportunity to girls over the age of sixteen, with the Boston High School of Practical Arts cooperating in the program. Mr. Norris pointed out the similarity between this plan and the one used by the New York Stock Exchange for its employees. He also stated that the Edison Electric Illuminating Company of Boston has an educational director.

The chief business of the meeting was the election to membership of sixteen candidates. The names, and respective school affiliations, follow: Robert W. Holmes, Shurtleff School, Chelsea; William T. Hanigan, Industrial School, Quincy; John F. O'Neil, Vocational School, Somerville; John Black, High School, Watertown; William H. Powers, Quincy School, Boston; Henry S. Needham, Parkman School, Boston; Lyman B. Sanborn, Jr., High School, Medford; Alfred A. Mann, High School, Medford; Eric Harrison, High School, Medford, James Robinson, High School, Medford; Wilbur A. Hart, High School, Medford; Clifford F. Dodge, High School, Medford; Thomas H. Johnston, Swan Junior High School, Medford; George W. Tait, Swan Junior High School, Medford; William S. Wood, Swan Junior High School, Medford; Ferdinand J. Toupence, Hobbs Junior High School, Medford.

Announcement was made of a trip through the plant of the Boston *Herald-Traveler* for Wednesday, February 23.—*Frederick Ames Coates.*

THE INDUSTRIAL-ARTS ROUND TABLE OF CHICAGO

The Industrial-Arts Round Table of Chicago held its February meeting at the Thornton Township High School, Harvey, Illinois. Supt. McVey and George Hay, vocational director, were on the reception committee and showed the guests the latest and best ideas in equipment and layout in the new school.

Following the dinner, Chairman Castle introduced Col. S. T. Hammond, president of the Whiting Corporation, who gave a talk on "Apprenticeship and Education." Col. Hammond brought out the fact that industry today has made a study of three main factors—men, methods, and machinery. A man need not have a degree to be able to give an expert or professional opinion along some special line but when the specialist meets other men from different departments, it is quite evident that he needs the culture and refinement which only reading and study give. Industry is today aware that it must give each man a chance to reach the utmost vocational level he is capable of reaching. It is education of this type that the large corporations of Harvey are offering when their eighty boys in the shops are sent back to school to balance their vocational needs. Col. Hammond declared it is easy, once a boy has entered work, to forget that he still has ambition. With a little encouragement and the right viewpoint of a more experienced man to set a definite objective before each apprentice, the progress normally shown in classroom work is maintained, talent saved for the state, and turnover for the company reduced. All this work is carried on by means of a coordinator, a man who possesses a good knowledge of local shop practice and who has a knowledge of the work of the common schools.

Col. Hammond, in his talk, pointed out that recent surveys show that only five per cent of the pupils in school have an adequate opportunity in professional, clerical or other "white-collar" jobs. On the other hand, he showed that there is a 52-per-cent definite opportunity for those able and willing to enter industrial lines. The industrial apprentice, said Col. Hammond, is considered the best material for potential production and management. He needs a chance to work and learn, and the means for acquiring definite information, especially the teaching of necessary and useful practices. The grades represented in the training group range from the fourth to high school, and each boy attends school a half day or more each week. The metal trades are represented in the Thornton Township High School and nearby cities send boys to Harvey for training. The boys in training take one or two periods of mathematics. The drawing work emphasizes the reading of blue prints; the theory of machine work embraces both reading of drawings and figuring, while training in English is obtained through the writing of reports and letters. In the laboratory work, mathematics, drawing, and writing are carried on as related work in industrial experiment, and reflects the work of the company from which the boy comes.

The discussion brought out the points that foremen are generally sympathetic after the difficulties are removed and the apprenticeship training plan is in operation. The plan involves a change in shop-training methods under which the training feature is taken from the foreman and placed in the hands of a skilled shop instructor, who is under the supervision of the school and the shop. It is found that where the company pays a large share of the expense of training apprentices, the dollar-appetite and fifty-cent ability disappear.—*R. B. Bagby.*

THE AMERICAN VOCATIONAL ASSOCIATION MEETING

Preparations are being rapidly completed for the next meeting of the American Vocational Association, which is to be held December 19, 20, and 21, at Los Angeles, California. At an executive meeting held in Los Angeles, Mr. Ben Pearson was elected chairman of the convention committee; Mr. W. S. Keinholz, vice-chairman, and Mr. B. W. Johnson, secretary. The chairmen of the various subcommittees will form the cabinet or working group under Mr. Pearson's direction. A "super" committee has also been appointed to cover the state for the purpose of securing greater cooperation.

The following committee chairmen have been appointed: Publicity, Albert Bullock; banquet, Vierling Kersey; exhibits, R. J. Casey; entertainment, H. A. Campion; entertainment for women, Miss G. Laurine Broadwell; registration, A. G. Waidelich; information, Hazel Moore; hotel reservation, L. G. Stier; meeting places, J. B. Corcoran; finance, Arthur Gould.

A number of sectional meetings have been arranged to include industrial education for men and women, vocational teacher-training, industrial and fine arts, vocational guidance, agricultural education, commercial education, part-time education, civilian rehabilitation, and home-economics education.

It is expected that the convention will be one of the largest ever held. The local convention committee is making every effort to extend the hospitality of the southwest to the visitors and it is assured that those in attendance will receive a hearty welcome to Los Angeles.

THE VOCATIONAL EDUCATION AND PRACTICAL-ARTS MEETINGS AT DALLAS, TEXAS

The subject of vocational education has never received the attention due it, at conventions of the National Education Association and of the Department of Superintendence, for the reason that those interested in the subject have been in the minority and have not been able to make themselves heard in the din of the discussion of academic phases of education. The recent convention at Dallas was no exception to the rule of the past ten years, but the relatively few men and women interested did hold two excellent sessions for the discussion of unified program of vocational education and practical arts. The Texas teachers and supervisors of vocational and industrial-arts subjects were splendidly represented by delegations from the larger cities. It is a pity that more superintendents of schools did not avail themselves of the opportunity of hearing the messages of progress of the several speakers, and of getting some insight into the spirit, aims, and effectiveness of the industrial-arts and vocational courses.

The first session on March 1 was presided over by Mr. N. S. Hunsdon, state director of industrial education for Texas. President H. L. Briggs, of Cleveland, opened the meeting with a general discussion of the need of attention to vocational work in high schools. So many high-school graduates go directly to work and they deserve and demand guidance and training for a specific vocation.

Mr. O. H. Day, director of vocational education and practical arts, Kansas City, Mo., discussed the program of work in his city where a $60,000 building was erected for the trade school by students. These boys received pay for two hours' work each day and attended class six hours. During the summer months they were employed full time on pay. Junior aeronautics, involving the making and flying of small airplane models are the latest feature of the industrial-arts work in the upper grades of Kansas City.

The practical program of vocational work in El Paso, Texas, was described to the department in a careful paper prepared by Mr. A. H. Hughey, superintendent of schools. Mr. Hughey described the development of courses for automechanics, the building trades, printing, machine-shop work, retail selling, etc., and showed how the cooperation of labor and of the business people is being secured.

The second session on Wednesday morning was presided over by Dr. Geo. E. Myers, of the University of Michigan. The first address was an inspirational discussion of the problem from the standpoint of industry, by C. L. Bailey, educational director of the Sheet Steel Trade Extension Committee of Pittsburgh. Mr. Bailey showed that in the typical American city seventeen per cent of all employed persons are engaged in the manufacturing industries and that these industries pay 55 per cent of the taxes for education. Ninety-six per cent of the students who enter the primary grades either leave school at the close of the grade-school period, or at some point in their high-school experience, and it is for these that some form of industrial or vocational training is essential. The children of the wage-earners of the United States are a problem which challenges the vocational educators of the country.

Dr. Wm. S. Taylor, dean of the College of Education of the University of Kentucky, discussed the same problem from the viewpoint of providing equal opportunity for all children and of affording each child some training to enter one of the more than 3,000 occupations in the industrial and commercial fields.

The meeting was closed by Mr. Edward A. Lee, president of the American Vocational Association, with an outline of the program of that organization, for a comprehensive program of training for the trades of agriculture, home economics, the rehabilitation of adults, and for the vocational education of adults. Mr. Lee suggested that the next important step in vocational education will be the development of vocational courses of junior-college grade for various types of technical occupations like architectural and mechanical drafting, industrial chemistry, and other high-grade occupations which have a nonprofessional status.

The Exhibits

The Department of Superintendence enjoyed at Dallas an exhibit of school art such as has not been seen either in quantity or quality at any previous convention. A total of 59 communities in 30 states made exhibits, ranging from simple grade drawing to elaborate vocational illustrations and decorative designs of junior-college grade. A noteworthy section was devoted to printing and to work produced in the platoon schools.

A large number of photographs showing interiors of modern school buildings, particularly school shops, home-mechanics and art rooms, was also a part of the exhibit. The exhibit was collected by Mr. Wm. H. Vogel, director of art of Cincinnati.

VOCATIONAL GUIDANCE ASSOCIATION MEETS

"Vocational Guidance Since 1918" was the general topic discussed by the National Vocational Guidance Association, at its convention February 24, 25, and 26 at Dallas. President A. Carson Ryan conducted the meetings with his usual force and modesty. There was ample evidence that the movement is rapidly emerging from the groping uncertainties of its early beginnings and is using valuable experience as well as dependable theory to build toward permanent usefulness. Dr. Ryan indicated this development in his introductory address when he said: "The world is no longer concerned only with vocational guidance, but educational, personal, and social guidance.

"The importance of vocational guidance is being stressed more than ever before. The problem has been approached psychologically. There is much more adequate knowledge of occupations in much more adequate form. The matter has been worked into social studies in better form than before. Junior high schools have taken up the study of vocations.

"Persons who have been trained specifically are placed in charge of vocational-guidance bureaus and similar organizations in various localities. Every possible source of training is being utilized by teachers and specialists. Newer psychology, psychiatry, mental hygiene, and social work have been introduced into the study and practice of vocational guidance. Books for study have been written and offered as college courses."

Among the speakers were: Geo. E. Hutcherson, Albany, N. Y.; H. F. Clark, Los Angeles, Calif.; M. F. Prunty, Tulsa, Okla.; Dr. Iva L. Peters, Syracuse, N. Y.; A. H. Edgerton, Madison, Wis.; Harry D. Kitson, New York, N. Y.; Anna B. Pratt, New York, N. Y.; Mary H. Hayes, New York, N. Y.; Geo. E. Myers, Lansing, Mich.; C. J. Crampton, Dallas, Tex.; Mabelle B. Blake, Smith College; Alma Fletcher, St. Louis, Mo.; Emma F. Phinney, New York, and others.

Sectional meetings were devoted to scholarships, occupational research, training programs for counseling, and placement. The following officers were elected for 1927-1928:

President, Dr. A. H. Edgerton, Madison, Wis.

Vice-President, Dr. Geo. F. Myers, Ann Arbor, Mich.

Secretary, Miss Virginia Peeler, Teachers College, New York City.

Treasurer, Miss Susan Ginn, Vocational Bureau, Boston, Mass.

Resolutions on the death of Frederick J. Allen of Harvard University, formerly editor of the *Vocational Guidance Magazine*, were adopted.

THE OKLAHOMA EDUCATION ASSOCIATION

The twenty-first annual convention of the Oklahoma Education Association was held at Oklahoma City Feb. 10-12, inclusive. The first manual-arts round table was held on Thursday evening, under the direction of Dr. Wm. T. Bawden, of Tulsa. The first speaker was Mr. W. H. Coppedge, of Okmulgee, whose topic was "Some Problems of the General Metal Shop." The speaker described the new type of shop, in which several kinds of activity are carried on at the same time. Such a shop might be equipped for sheet-metal work, electrical work, forging, pipe-fitting, and some cast-metal work in aluminum, or some machine work on engine lathes and grinders. This type of organization has its advantages for smaller schools, in that more varieties of experiences can be provided, at a great saving in equipment and floor space.

Mr. G. B. Willet's discussion on "Facilities and Conveniences in School-Shop Equipment" was well received. The speaker brought out quite a number of points on shop arrangements that were quite worth while; perhaps the most outstanding one was that pupils should be taught to have a certain pride in keeping their bench, their tools, and the shop in general, in the best possible working condition.

On the morning of the next day, business men of Oklahoma City Chamber of Commerce conducted parties of teachers through some of the industrial plants of the city.

The next event was a jollification luncheon of the combined groups of manual-arts instructors, vocational-education, agriculture, and home-economics teachers. Some 200 persons were in attendance. The outstanding serious thought engendered by the meeting was that relative to civilian rehabilitation. It was stated that there were about 300,000 crippled persons in the United States, and that these persons did not want pity, but a chance to learn some sort of gainful vocation, in order that they might live as normally as other people.

The industrial-education section of the association was fortunate in procuring for its meetings the services of Mr. L. H. Dennis, deputy commissioner of the state department of public instruction, Pennsylvania, in charge of vocational education and part-time education. Mr. Dennis' plea was that it is the task of the group comprised of manual-arts, vocational-education, and agriculture instructors, to see to it that more educational opportunities are provided for the great majority of pupils who must leave school at an early age to enter industry. The present teachers must help educate their respective administrative officers as to the need for this type of educational opportunity whenever possible. Mr. Dennis asserted the reason comparatively little has been done so far is that the public has not been sufficiently informed as to what is, and what can be done; that

when the public understands it will demand that more vocational education of various kinds shall be provided.

During the afternoon, the Roosevelt Junior High School conducted an open house for visiting teachers. Some interesting work is being done in the manual-arts department. An interesting industrial-arts exhibit, comprising quite a variety of work, ranging from work done by pupils in the kindergarten, to that turned out by junior-high pupils, was open to teachers at the Shrine Temple. The latter part of the afternoon was taken up by a trip through the Ford assembly plant located in Oklahoma City.

The first speaker of the evening session was Mr. J. W. Bollinger, of Tulsa, who discussed the topic: "Use of Individual Instruction Sheets in the General Metal Shop." Mr. Bollinger centered his discussion around the unit-operation method of shop instruction perfected by Prof. R. W. Selvidge of Missouri, asserting that this method was a long step forward in the matter of more efficient shop teaching.

Mr. L. K. Covell, of Chickasha, concluded the program with a talk on the topic: "Suggestions on the Use of a Text in Shopwork." It was stated that a text was indispensable; that teaching of related matter was of at least equal importance with the actual doing of trade work; and that the best method of using the text was to require students to be able to answer questions, the answers to which could only be found by thoroughly mastering the material in the text.

Before adjournment it was decided to assess each member for the purpose of bringing to the meetings some well-known man in the field of manual arts.

Mr. Ward Chase, in charge of industrial education at the teacher-training college at Edmond, Oklahoma, was elected as chairman of the industrial-education section of the association for next year.—*J. W. Bollinger.*

NOW, ARE THERE ANY QUESTIONS?

History of Tool-Making

697. Q.: Has anyone compiled data on the history of common tools?—J. N. P.

A.: Considerable help on this subject may be obtained from the following publications: *Roe's English and American Tool Builders,* $3, Yale University Press, New Haven, Conn.; *Kaempffert's Popular History of American Inventions,* $10, Chas. Scribner's Sons, New York City; *McFee's Stories of American Inventions,* $1.60, Thomas Y. Crowell Co., New York City; *Williams' Romance of Modern Invention,* $3, J. B. Lippincott Co., Philadelphia, Pa.

National Indoor Model Airplane Contest. The Detroit Free Press of Detroit, Mich., has offered to furnish descriptive pamphlets for the making of model airplanes in preparation for the first national indoor contest to be held in March, 1927, at the Cass Technical High School. In addition to the Stout Duralumin Trophy, there will be eight cash prizes amounting to a total of $500. The contest is to be held under the direction of the American Association of Model Aero Clubs, and the arrangements for the contest are sponsored by the Detroit public schools, through the department of vocational education.

Books on Wood Finishing

715. Q. As a reader of the INDUSTRIAL-ARTS MAGAZINE I am writing you to find out where I can secure some books on wood finishing. I am particularly interested in the book entitled "Problems of the Finishing Room" by Schmidt, also any other reliable books on wood finishing which you can recommend to me.—H.C.H.

A. The following list of books will be very useful. No school shop should be without the first three titles on the list.

Schmidt's *Problems of the Finishing Room,* $5, Periodical Publishing Co., Grand Rapids, Mich.; Jeffrey's *Wood Finishing,* $1.50, Manual Arts Press, Peoria, Illinois; *1995 Paint Questions Answered,* $6, Painters Magazine, New York; Kelly's *Expert Wood Finisher,* $3, Ashmun Kelly, Malvern, Pa.; Denning's *Polishes and Stains for Wood,* $1.40, Chas. Scribner's Sons, New York; Hasluck's *Wood Finishing,* $1, David McKay, Philadelphia, Pa.; Hiscox's *Henley's Century Book of Recipes, Formulas, and Processes,* $3, Painters Magazine, New York; Galloway's *Staining, Varnishing, and Enameling,* $1.25, Painters Magazine, New York; *Staining and Polishing,* 87 cents, J. B. Lippincott, Philadelphia, Pa.; Behlen's *Art of Wood Finishing,* $1, H. Behlen & Bro., New York; Parkhouse's *Practical Polishing and Staining,* $3, D. Van Nostrand Co., New York; Vanderwalker's *Wood Finishing,* $2, F. J. Drake Co., Chicago, Ill.; Lowndes's *Painting and Wood Finishing,* $1.50, David McKay, Philadelphia, Pa.; Kelly's *Expert House Painter,* $3.50, A. A. Kelly, Malvern, Pa.; Sabin's *House Painting,* $1.50, John Wiley, New York, N. Y.; Young's *Practical Painting and Paperhanging,* Century Vocational Series, Pratt Institute, Brooklyn, N. Y.; *Principles and Practices of Up-Keep Painting,* $2, E. I. du Pont de Nemours & Co., 35th St. and Gray's Ferry Road, Philadelphia, Pa.; *Cyclopedia of Paint Information,* National Lead Co., New York, Chicago, and Boston.

MR. CHAPMAN APPOINTED VOCATIONAL DIRECTOR OF GEORGIA

Mr. Paul W. Chapman, who has been appointed State Director of Vocational Education for Georgia, is well known in his state where he has been active in the promotion of agricultural education. Mr. Chapman was the first supervisor of agriculture in Missouri and was instrumental in organizing the state department for taking over the Smith-Hughes work. He came to Georgia as state supervisor of agricultural education in 1920, succeeding Mr. R. D. Maltby.

Mr. Chapman is the author of the pamphlet, "The Promotion of Agricultural Education," which was issued by the

PAUL W. CHAPMAN,
State Director of Vocational Education, Athens, Ga.

Federal Board for Vocational Education. He is a member of the editorial staff for the *Progressive Farmer,* and is the author of a number of texts on agriculture and agricultural life. He has been active in conference and lecture work in vocational agriculture and is on the committee on agriculture of the American Vocational Association.

On February 23, the tenth anniversary of the signing of the Smith-Hughes law, Mr. Chapman was privileged to present to the state of Georgia, the gold pen used by President Wilson in signing the Smith-Hughes law. The pen was given to Mr. Dudley M. Hughes of Danville, Ga., at the time of the signing of the law, and the latter then gave it to Mr. Chapman to present to the state. The pen holder is of heavy walnut stock and is enclosed in a walnut case with silver bands.

SHOP-TEACHER'S CALENDAR

Tasks for April Shop Management—Submit list of tools and equipment needed for next year. Hold teachers' meetings to discuss problems and projects.

Instruction—Continue talks on vocational subjects. Emphasize trade selections. Begin model airplane competitions. Set out bird houses.

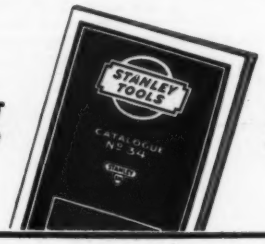
Problems—Begin the construction of spring projects such as garden utilities, window boxes, playground apparatus, and the like.

Community Service—Cooperate with local agencies in making plans for the spring clean-up.

Annual Exhibit—Begin gathering materials for annual exhibit.

Professional Work—Begin plans for summer study or work.

STANLEY EQUIPMENT IS STANDARD EQUIPMENT

Use this catalog  *for a reference book!*

Stanley Tools recommended for manual art classes

New Equipment—or replacement

THE following list, selected from Catalog No. 34-G, gives our recommendations for the most practical tool equipment for manual arts classes. This equipment combines utility with economy to a surprising degree. Stanley equipment in your tool room will give that great sense of satisfaction to you and to your students that always goes with using the best.

PLANES
Stanley Steel Smooth Plane No. S4
Stanley Steel Jack Plane No. S5
Stanley Steel Block Plane No. S18
Stanley Bailey Smooth Plane No. 4
Stanley Bailey Junior Jack Plane No. 5¼
Stanley Bailey Jack Plane No. 5
Stanley Bailey Fore Plane No. 6
Stanley Bailey Block Plane No. 18
Stanley Combination Plane No. 45
Stanley Rabbet Plane No. 78

CHISELS
Stanley Everlasting Chisel No. 40
Sizes 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/4, 1 1/2, 1 3/4, 2"

GAUGES
Stanley Marking Gauge No. 265
Stanley Mortise & Marking Gauge No. 77

RULES
Stanley One Foot Rule, Maple, One Piece No. 34¼
Stanley One Foot Rule, Boxwood, One Piece No. 34½
Stanley Two Foot Rule, Maple, One Piece No. 34

TRY SQUARES
Stanley Try Square No. 12—6"
Stanley Try Square No. 10—6"

HAMMERS
Stanley Nail Hammer No. 12—7 oz.
Stanley Nail Hammer No. 12—10 oz.
Stanley Nail Hammer No. 12—13 oz.

SCREW DRIVERS
Stanley Hurwood Screw Drivers No. 20
(Specify length of blade from ferrule to tip.) Sizes 2½, 3, 4, 5, 6, 8, 10" and larger

BIT BRACES
Stanley Plain Brace No. 924—8"
Stanley Ratchet Brace No. 923—8"
Stanley Ratchet Brace, Ball-bearing chuck No. 813—8"

SPOKE SHAVE
Stanley Adjustable Spoke Shave No. 151

T BEVELS
Stanley T Bevel No. 18—8"
Stanley T Bevel No. 25—8"

MITRE BOXES
Stanley Mitre Box 26"x4" saw No. 246
Stanley Mitre Box 28"x5" saw No. 358

STEEL SQUARES
Stanley Steel Square No. 3
Stanley Steel Square (Rafter tables) No. R100

SCRAPERS
Stanley Cabinet Scraper No. 80
Stanley Hand Scraper No. 0—3"x5"

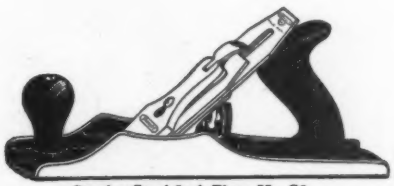
SAW SET
Stanley Saw Set No. 42

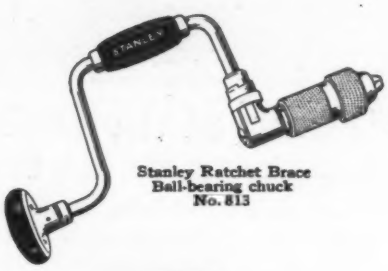
SCREW DRIVER BITS
Stanley Screw Driver Bits No. 26
Tips 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4"

NAIL SET
Stanley Nail Set No. 11½

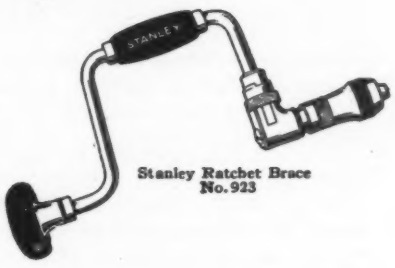
The Stanley Catalog No. 34-G should be in the hands of every manual arts supervisor and instructor. It lists and shows pictures of over 1,500 items, as well as detailed drawings of their construction and adjustment. In addition, the appendix gives a number of tables covering subjects pertinent to woodworking.

THE STANLEY RULE AND LEVEL PLANT
Educational Department, New Britain, Conn.
New York Chicago San Francisco Los Angeles Seattle

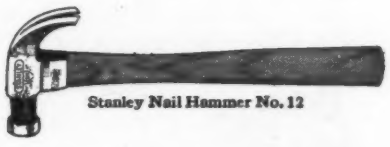

Stanley Steel Jack Plane No. S5



Stanley Ratchet Brace Ball-bearing chuck No. 813



Stanley Ratchet Brace No. 923

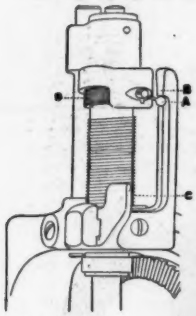

Stanley Nail Hammer No. 12

Stanley Everlasting Chisel No. 40

STANLEY S.W.

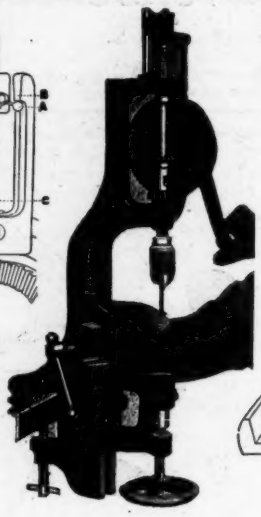
STANLEY TOOLS

Good Schools Deserve "Yankee" Tools

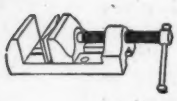


Enlargement of head of "Yankee" Automatic Feed Bench Drill.

D—Ratchet Teeth. A—Ratchet Shifter in "knock-off" position at extreme of up movement. B and C Automatic "knock-offs" at top and bottom.



"Yankee" Vise No. 990. Designed for use on Bench Drills. Machined true on ends, bottom and sides. Swivel jaw for taper work. Jaws open 3 in.



Think of the Drills It Saves

And saving drills is saving money!

No amount of experience could teach anyone—even a mechanic—to regulate the pressure on drills as evenly as this "Yankee" Automatic Feed Bench Drill does it for him.

The Automatic Ratchet Feed takes the place of hand feeding. One hand is always free to hold work. It adjusts the pressure perfectly for all drills from the smallest up. This saves drills.

Just turn crank. Friction feed runs drill down to work. Then Ratchet Feed operates.

Accident-proof! Automatically knocks off Ratchet Feed at end of upward and downward movement, preventing jamming, stripping, or broken gear teeth.

No. 1005 (illustrated). Two speeds; 3 jaw chuck holds drills up to ½ in. Entire length 28 in.

No. 1003. Single speed; 3 jaw chuck holds drills up to ¼ in. Entire length, 18¾ in.

Some Other "Yankee" Tools

Ratchet Hand Drills
Ratchet Breast Drills
Ratchet Bit Braces
Ratchet Screw Drivers
Ratchet Tap Wrenches
Automatic Push Drills

Dealers Everywhere Sell "Yankee" Tools

Write for FREE "Yankee" Tool Book

This interesting little book is for all lovers of fine tools. It tells just what you want to know about all the famous "Yankee" Tools for making work easier and quicker.

"Yankee" on the tool you buy, means the utmost in quality, efficiency and durability.

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

NEWS AND NOTES

Vocational-Guidance Institute. A vocational-guidance institute was conducted in January and February at Austin, Minn., under the direction of Dr. J. Adams Puffer and was intended to help junior and senior high-school students to find their right places in industry.

Under the plan adopted for continuing the work, assemblies of the school are each week given over to lectures by leading business and professional men supplanted by the superintendent and the principal on subjects connected with the current student advisory lessons.

Home-Economics Meeting. The American Home-Economics Association will hold its twentieth annual meeting June 21 to 24, at Asheville, N. C. A feature of the program will be the annual "progress meeting," at which representatives of the various sections will give brief, vivid summaries of the year's scientific progress in their respective subjects.

Vocational Day. A vocational day was held at the Tenino school, Tenino, Wash., on February 11, to give students an idea of what line of work they desired to take up after leaving school. Among the speakers on the program were W. U. Neely, assistant state superintendent; C. L. Carroll, superintendent of Thurston county schools, and E. B. Stookey, Thurston county agent.

Wins Prize in Building Contest. Fred S. Patterson, a student in the Greensboro Vocational School, at Greensboro, N. C., recently won the prize of $25 for the best design of a modern English home, to be built in one of the residence sections of the city. A home built according to the plans will be erected in the near future.

Carpentry Class Added. Six departments were in operation at the Greensboro Vocational School, Greensboro, N. C., with the opening of the spring session. A class in carpentry has been formed under the direction of Mr. J. R. Rumbley. Other trade classes in operation are those in plumbing, lead wiping, electricity, steamfitting, and architectural drawing.

Industrial School Planned. The board of education at Akron, Ohio, plans the establishment of an industrial school in the old Spicer building. Sixteen rooms will be provided with shop equipment.

Evening Vocational Courses. The board of education of Freeport, Ill., recently opened its third annual evening school. Such courses as mechanical drawing, machine drawing, architectural drawing, lettering, color sketching, dressmaking and patternmaking, and electromechanics are offered.

Boys and young men employed as apprentices in the building, plumbing, sheet-metal, and machinist trades are given an opportunity to obtain advanced instruction through work in drawing, blue printing, and arithmetic.

Graduate Patternmakers. The vocational-training department of the Academy High School, Erie, Pa., recently graduated three pupils from the patternmaking class. Each boy was presented with a certificate signed by the state education department and the local school board.

Springfield, Missouri, has recently extended its Smith-Hughes day trade course in carpentry. Two groups of students per day will now take the work instead of one group per day as heretofore. Robert Runge, supervisor of industrial arts, has secured a practical project for the carpentry classes and the boys are now building a cottage under the direction of Carl Thompson, carpentry teacher.

The automechanics shop in the all-day vocational department of the Joplin, Missouri, high school has built up a strong sentiment in favor of trade training for automechanics. The instructor, Mr. R. W. Emerson, has been able to secure a splendid variety of practical repair jobs which he has classified and used for instructional purposes.

The students of the Lathrop Trade School, Kansas City, Missouri, have recently completed an $80,000 addition to their building. The administration is planning to enlarge its program of vocational education by the addition of courses in instruction in the machinist and the plumbing trades. Mr. O. H. Day is director of vocational education in Kansas City, Missouri.

Vocational Pupils Receive Honor Awards. Fifteen students of the Fond du Lac Vocational School, Fond du Lac, Wis., were recently given certificates for good work in trades courses. The certificates contain the seal of the school and certify that the student has satisfactorily completed his studies.

Manual-Training Boys Make Furniture. Second-year boys of the manual-training department of Jackson, Ohio, have begun the construction of large pieces of furniture such as bookcases and dressers.

Students Earn Large Profits. Ten students of the Hahira School at Valdosta, Ga., in Lowndes county, earned $4,000 last year in vocational work at the school.

Electrical-Engineering Class. Forty-five men were enrolled in the electrical-engineering class conducted during January at the Vocational School, St. Petersburg, Fla. The students were university graduates and others with experience in electricity. Classes in plaque work, millinery, and industrial arts were held at the girls' junior high school in the night school for women.

Organize Florida Association. A Florida Vocational Association has been organized, with members representative of the trades and industries, the manual arts, home economics, and agriculture.

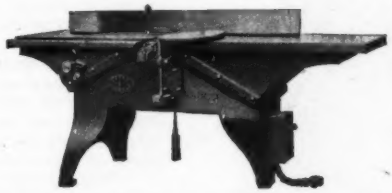
(Continued on Page 30a.)

WOODWORKING MACHINERY

"The SHORTEST DISTANCE TO PROFIT"

GEOMETRY teaches, among other things, that a straight line is the shortest distance between two points. Change this to read, "Straight-line methods represent the shortest distance to Profit," and you have an axiom in the mathematics of modern business. In the woodworking industry those who meet competition most successfully, thereby realizing maximum profits, are those who employ modern machines —and methods. They tolerate no "detours"; they insist upon straight-line methods. To achieve this, they use Yates-American Machines. Hundreds of manual training departments are preparing students along these same lines by furnishing them with the equipment which the industry considers as standard — Yates-American. Some day a host of these students will be an important part of this industry as machine operators, managers, engineers, mill and factory owners. And to learn on the standard machine equipment of the industry is none too good for those who tomorrow will be its leaders.

Teach your students today on the machines they will use tomorrow. Yates-American machines are recognized as the standard the world over.



No. 1 Hand Jointer handles such work as squaring, smoothing, jointing, beveling, cornering, cross-graining, etc. A valuable all around tool.

Yates-American Machine Company, Beloit, Wisconsin, U. S. A., is the world's largest woodworking machinery manufacturer. It also sells exclusively the products of the Jenkins Machine Company, Baxter D. Whitney & Son, Inc., and the L. G. McKnight & Son Company.

EDUCATIONAL DEPT., BELOIT, WIS.

YATES-AMERICAN

See the Point?

Some people think the point of a drill is the extreme tip of the cutting end!

Actually, that extreme tip is known as the "Dead Center"—while "The Point" is the *entire* cone-shaped surface at the cutting end. All that you see in the illustration above is "The Point."

This is only one of the many interesting and instructive definitions to be found in the Handbook for Drillers. In it every part of a twist drill is clearly and simply described—plus a great deal of useful information on grinding, cutting speeds, feeds and how to secure the best results when drilling in various metals.

Vocational Directors and Instructors are invited to ask for copies of the Handbook, in any reasonable quantities, for the use of their machine shop classes.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND
NEW YORK-CHICAGO-LONDON

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

Manufacturers of Carbon and Cle-Forge High Speed Drills for every purpose; "Mesco" Super-Carbon Drills; Hand, Jobbers' and Shell Reamers; "Peerless" High Speed Reamers; "Paradox" Adjustable Reamers; "Quick-Set" Reamers "Spirex" Machine Taper Pin Reamers; Chucking Reamers for Turret Lathes; Counterbores; Countersinks; Sockets; End Mills; and the "Exy-Out" Screw Extractor.

(Continued from Page 28a.)

Mr. E. W. Harris, state supervisor of agricultural education, is president, and Miss Ida Anders, state supervisor of home economics, is secretary and treasurer.

Boys' Vocational Conference. The annual boys' vocational conference of Montana was held in January, at Bozeman. The conference has a large attendance and draws delegates from many northwestern states.

Vocational Agriculture. A day-unit course in vocational agriculture has been added in the Ennis High School at Ennis, Tex. The course runs for about six weeks and consists mainly of a study of poultry.

Boys Build Furniture. The manual-training department at Booneville, Ind., has turned out two excellent pieces of fine furniture under the direction of the instructor. One student completed a six-leg, extension, dining-room table, and another constructed a flat-top desk for the drafting room.

Build Airplane. The manual-training department at Sioux City, Iowa, has begun the construction of an airplane which is to be completed this spring. The airplane is being built by two students of the department, who are familiar with the manufacture and piloting of airplanes.

New Vocational School. The vocational school now under construction at Norristown, Pa., will be ready for occupancy at the opening of the next fall term. It is planned to include provisions for the newer vocational work such as electricity, automobile mechanics, sheet-metal work, and similar trade subjects.

Construct Metal Problems. Andirons and other metal projects have been made in the machine section of the vocational department of the Main Avenue Senior School at San Antonio, Tex. Among the articles turned out by the class were daggers, letter openers, rings, and belt buckles.

Establish Salesmanship Classes. Salesmanship, advertising, and allied courses for employees of stores and business houses have been established at Erie, Pa. The classes will be maintained along the same lines as the vocational classes in Erie schools.

High-School Vocational Courses. Smith-Hughes vocational courses in home economics and agriculture will be offered at Rupert, Idaho, next September.

Day Courses in Sheet Metal. Sheet-metal work has recently been added to the day-school courses offered at the Boys' Vocational School, Newark, N. J. The class is conducted under the direction of Mr. E. F. Sullivan.

Vocational Training at Detroit. "Let's Know Detroit" courses are offered in the academic schools of Detroit, Mich., by the vocational-education department. They are industrial-mechanics courses designed to meet the demand for industrial information by persons in professional and commercial pursuits. The courses cover four semesters and instruction is given in general shops, with a variety of equipment, supplemented by specialized shops.

New Manual-Training Department. A manual-training room has been provided in the new annex of the West Reading, Pa., school.

Open New Vocational School. The vocational school at Janesville, Wis., opened the last term in its new quarters in the old high-school building. The building has been entirely remodeled and much new equipment added.

Vocational Education for Decorating Trades. The Nebraska Master-Painters' Association at its recent meeting gave out some interesting facts relative to the decorative industry. In the years before the operation of the present protective immigration law, a large percentage of the new workers in the decorating trades were recruited from abroad. At the present time very few skilled decorators are entering the country from abroad.

A census of Nebraska shows that there were 3,280 journeymen painters in the state in 1920 with only thirty apprentices, while the number of apprentices the country over is six and one-half per one thousand journeymen. The apprentice quota rules fixed by different painters' unions vary somewhat in different localities, but they, in general, allow one apprentice for every five to seven journeymen. On this basis alone there should be 656 decorator apprentices in the state instead of only thirty.

The association recently passed resolutions requesting the assistance of the schools in helping to solve their problems, and outlined two ways in which the schools might be of assistance. The association urged the establishment of trade-preparatory classes for boys on a full-time basis, and trade-extension classes for men already in the trade.

The course, it was suggested, should be under an expert craftsman and the instruction on the paint side should include a study of the theory of color, color mixing, color harmonies, stippling, mottling, stencil cutting, stenciling, paint chemistry, and design. The wallpaper course should consist of a study of materials, preparation of surfaces, application of different kinds of papers, paneling, and design.

Establish Vocational School. The board of education of St. Louis has made provision for the equipment of the new vocational school, the cost of the same to reach $25,000.

(Continued on Page 32a.)

This machine uses a standard moving picture film but is not a movie. We have a limited number of machines which we can lend to those making first application — or machines can be rented in your city.

Here is something new!

We will supply free of charge to any vocational school or college a film illustrating a lecture on "Fundamentals of Efficient Milling Practice." With the film we will send a printed lecture for the use of the instructor in presenting the film — and a sufficient quantity of these printed booklets, fully illustrated, for distribution to pupils after the lecture—all with no obligation. This is the first time such an unusual offer as this has ever been made by our company. Requests should be made by machine shop instructors or school authorities.

Cincinnati Milling Machine Co.
Cincinnati, Ohio

CINCINNATI MILLERS

Every Manual Training Class Room *should have this Complete Set* of IRWIN BITS

THIS set of genuine Irwin Auger Bits, ranging in 16ths of an inch, from one-quarter inch to one inch, is deserving of a place in every well equipped manual training or industrial arts workshop.

The thirteen auger bits comprising the set are all Irwin Mainbor Bits, made with the solid-center principle originated by Irwin 41 years ago.

Kept intact in the original container—Borcase or Borkit—they will remain in perfect condition indefinitely.

Write to us, mentioning this advertisement, and we will be glad to give you details regarding special introductory offer.

Write for the facts today.

THE IRWIN AUGER BIT COMPANY
Wilmington, Ohio.

"Largest Makers of Wood-Boring Tools in the World."

IRWIN *Auger Bits*

(Continued from Page 30a.)

Millville Vocational School. One of the projects undertaken by the home-economics students of Millville, Pa., this year is the planning and furnishing of the family kitchen and dining room in the homemaking cottage. The home-economics department conducts an information service for homemakers of the community.

College Students Undertake Practice Teaching. Eighteen students of the clothing classes in the College of Industrial Arts, Denton, Texas, are doing practice teaching in the city schools. There are home-economics clubs in the schools; the classes have had special displays of their work, have conducted sales to raise money for sending delegates to the state meeting, have encouraged mothers to visit the classes, and have contributed sunshine baskets for the needy at Christmastime.

The clothing course for the freshman and sophomore classes was recently organized to emphasize design, care, hygiene, and economics, rather than construction. The economics of clothing is studied as a foundation for budget work and each student is required to keep an account of the expenditures.

Vocational School. The board of education of Wheeling, W. Va., has established a vocational school in which instruction is given supplementary to the trade taught. The school meets the requirements for Smith-Hughes aid.

Vocational Conference. A vocational conference for colored men was held January 28 and 29, at the A. and E. College, Greensboro, N. C. The conference was called to help men interested in vocational and technical training.

Safety Course for Teachers. A free lecture course for vocational teachers on the principles and practice of accident prevention has been arranged by the industrial commissioner of New York state, in cooperation with the division of vocational and extension education of the state education department. The course consists of fifteen lectures, which are given in Buffalo, Rochester, Syracuse, Oswego, and Schenectady.

Meadowview, Va. The public elementary school here has inaugurated a department of home economics as part of the second semester's work for the seventh grade. The department is in charge of Mrs. Hazel T. Beck. While the girls are taking this course the boys of the seventh grade will be studying agriculture under the direction of D. G. Tiller. The latter course will include field and experimental work. The former will include a hot-lunch project with a group of undernourished children.

Extension Work Among Farmers. Cooperative extension work in agriculture and home economics has made remarkable progress along educational lines, according to Mr. C. W. Warburton, director of extension work in the United States Department of Agriculture. This type of education is primarily a supplementary educational system designed to help the farmer and his wife and involving boys' and girls' club work, in which about 600,000 boys and girls were enrolled last year.

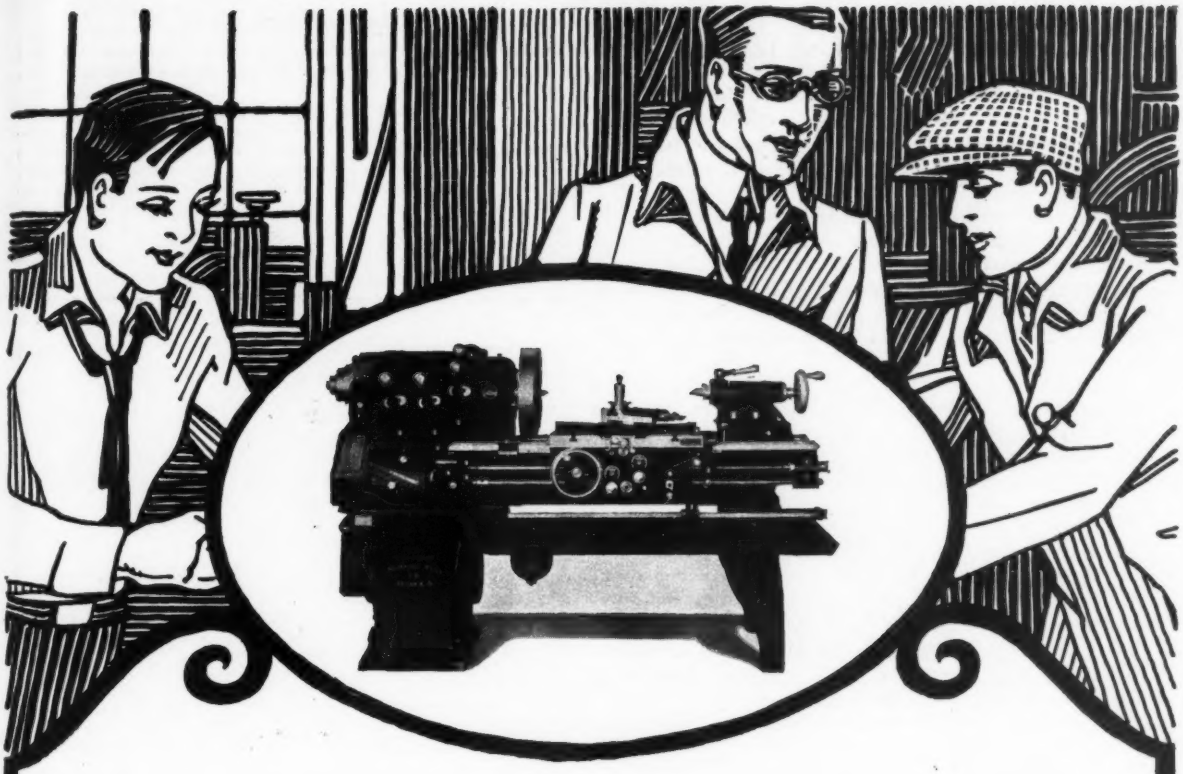
The work in agriculture is financed jointly by the county, the state, and the federal government. In the state, its administration centers in the director of extension in the College of Agriculture. In the county, the college and the federal department of agriculture are represented by the county agricultural agent, and by the home demonstration agent. In some sections of the county, particularly New York and New England, county-club agents are employed to work wholly with boys and girls.

The extension system does not conflict with, or overlap any other part of the educational system. The vocational schools provide instruction for those who have time and opportunity to attend classes. The College of Agriculture provides special training for a limited number who desire to become teachers, county agents, or experimenters. The extension service, on its part, is intended to supplement these other agencies. The county extension agent is the keystone of the entire extension structure and he has at his finger tips the resources of the state college, the experiment station, and the federal government. Upon the shoulders of the county agent rests the responsibility of bringing the store of knowledge in these institutions to bear on the problems of the farm and the farm home in every community.

Veterinary Education Encouraged. The Bureau of Animal Industry, of the U. S. Department of Agriculture, reports a reduction in the number of veterinary colleges in recent years and in the number of applicants for federal veterinary positions. The U. S. Civil Service Commission, which conducts examinations for federal veterinary work, calls attention to a general scarcity of qualified applicants. The last annual report of the Bureau of Animal Industry showed that the total student enrollment in the thirteen accredited veterinary colleges was 582 and the number of graduates was only 132, or eleven less than in 1925. In the combined freshmen classes of all colleges there was an increase of but two in 1926.

Trades School for Girls in the District of Columbia. Washington's first trades school for white girls was opened February 1, under the direction of Miss Mary Lackey, principal. The school will parallel the work being done for boys at the Abbott school. In addition to the principal there is a teacher of domestic art and a teacher

(Concluded on Page 38a.)



Train Your Students for their Jobs — Use MONARCH LATHES

Train your students on MONARCH LATHES and when they go from your school they will be ready for their jobs —valuable men immediately without the necessity of going through another period of training in the shop.

The student that is trained on a Monarch Lathe is trained in actual shop practice — for the Monarch is the first choice of Industrial America. Today more Monarch Lathes are being sold to industrial plants than any other lathe built.

The Monarch motor-driven, helical geared Lathe is the ideal equipment for instructional purposes. It is far in advance of other lathes in design. It is as near danger-proof as any lathe can be made. It is as noiseless as any lathe can be—an important advantage in the instruction room.

Monarch Lathes are used in the Massachusetts Institute of Technology, Yale, Cornell, and in hundreds of the best technical and high schools — proof that the Monarch is the practical lathe for modern school equipment.

The success of your school and the success of your students are inseparably linked together. Use MONARCH LATHES and meet the modern demand for training that *fits men for their jobs.*

Illustration above shows 14 x 6 helical geared Monarch Lathe

THE MONARCH MACHINE TOOL CO.

100 OAK STREET - - - - - - SIDNEY, OHIO

SCHOOL SHOP EQUIPMENT NEWS

For the Supervisor and Teacher who desires to keep abreast with news of new Machinery, Tools, Supplies, etc.

THE TURRET LATHE—WHERE TO LOOK FOR "NET PROFITS"

How This Applies to the School Shop

Shop teachers as well as academic teachers can obtain valuable information on production in industry from the pamphlet, "Where to Look for Net Profits", published by the Warner Swasey Co.

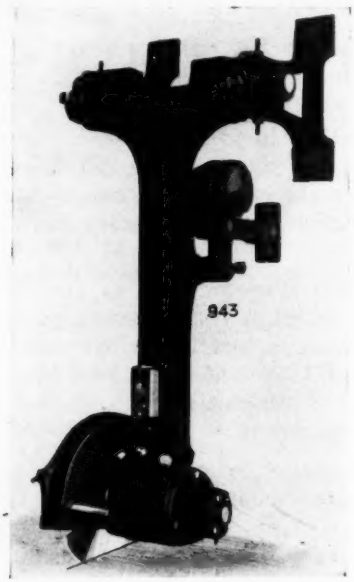
Production is the keyword in industry—how much should the students in the schools know about it? To what extent should they be taught production methods in shop work? Teachers owe it to the students and to themselves to be informed on the best industrial practices used in industry in order that they may be able to impart some vocational information to the students.

The commercial teachers in a high school can develop some interesting problems on costs of production by giving practical, rather than abstract, problems to the class. In the vocational school where the teachers have the opportunity to present both shop and academic work, splendid correlated problems can be worked out from this pamphlet.

It is of great importance that all shop work—yes, all school work, be tied up with industry in some form so that the student forced to leave school would have a better understanding of what modern business expects from him when earning a livelihood; hence, it is the teacher's job to keep in touch with modern industry.—*F. W. Z.*

THE MONARCH SWING SAW A CONVENIENT AND EFFICIENT TOOL

The American Saw Mill Machinery Company, of Hackettstown, N. J., has recently placed on the market a new swing saw which has the advantages of convenience and adaptability, as well as efficiency in operation. The saw is known as the Monarch motor-thread swing saw and is manufactured by the above named firm at Hackettstown, N. J.



THE NEW MONARCH SWING SAW.

The tool uses saws up to sixteen inches diameter and has a maximum depth of cut of four inches and eighteen inches wide. The saw may be mounted on a side wall or ceiling, and is provided with an automatic counterbalance, which makes it easy for uniform pull either front or back.

The saw is driven by one-horsepower, three-phase motor, is of ball-bearing construction, and is adequately ventilated. The saw comes equipped with push-button control and magnetic starter. An important feature of the saw is the safety guard, which covers the entire saw and yet allows for any thickness of material without interference with the guard.

NOT AN ORIGINAL VISE

Information has come to the editors of the MAGAZINE that the vise published on pages 72 and 73 of the February issue is based on a patented design of L. S. Starrett Company. Reproductions cannot be made without permission of the manufacturers. Neither the author of the article nor the editors had knowledge of the facts just stated.

ISSUE USEFUL SAW CHARTS

Henry Disston & Sons of Philadelphia, Pa., have issued two useful saw charts as a means of illustrating the differences between rip saws and crosscut saws. The pamphlets are illustrated with pictures which serve to indicate the usefulness of these saws and their

HOW TO USE
HAND SAW for CROSSCUTTING
EDUCATIONAL DEPARTMENT
HENRY DISSTON & SONS, INC.
SAWS · TOOLS · FILES · MACHINE KNIVES
PHILADELPHIA, PENNA.

A SIMILAR CHART ILLUSTRATES THE USE OF THE RIP SAW.

chief characteristics to shop classes. Not only do they distinguish between the shape and bevel of the teeth, but the cutting action of the rip and crosscut teeth is clearly shown for the benefit of pupils. Proper position, method of starting a saw cut, and errors to be avoided in using a hand saw complete two well-prepared shop aids.

The charts are 14 inches by 19 inches in size, and are printed on heavy, dull-glazed paper. The firm offers to send complimentary copies of the saw charts to shop teachers upon request.

A WOODWORKING MACHINERY CATALOG

Supervisors and teachers of woodwork will be interested in a new catalog published by the Yates-American Machine Company, Beloit, Wis. In this catalog woodworking machinery having application beginning with the Junior High School and ending with heavy-production machines in industry, is well illustrated. Moreover, supervisors and teachers can clearly see the development of woodworking machinery from belt-driven to direct motor-driven types.

CHUCKS AND THEIR USES

This interesting booklet published by the Skinner Chuck Company, illustrates some splendid chucking "set-ups" for teachers of metal working.

The development of the chuck, the various types manufactured, and the proper type of chuck to use for the various types of work, are some of the things featured in this booklet.

Moreover the chucking operations done on milling machines and grinders will give helpful suggestions to those teachers who have problems of this type to master.

Instructors of advanced machine-shop practice in special or trade schools can obtain information on the air chuck. Although this type of chuck is used only in connection with production work, yet the students can profit by instruction as to why and where air chucks are used to good advantage in industrial establishments.

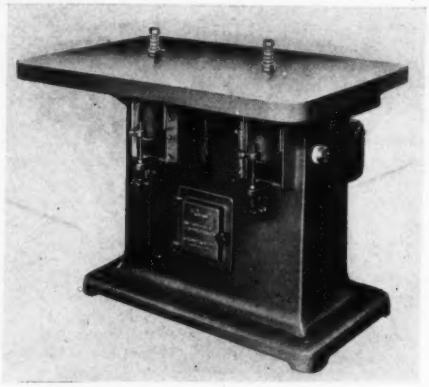
A NEW DOUBLE-SPINDLE SHAPER

The Gallmeyer & Livingston Co., Grand Rapids, Mich., have announced a new motor-driven double-spindle shaper which is the latest addition to the union line. The new features of these shapers are that two distinct types are available, namely, the 7200 r.p.m. type stepped up by means of a frequency changer; the other a 9000 r.p.m. type driven by belt from motors set in a vertical position. This method eliminates all twists in belts, idlers, etc., yet provides for the desired speeds. On this type two different type motors can be had; the ½ h. p. type driven from the lamp socket, or the larger motor type driven from the power line.

(Concluded from Page 32a.)

(Concluded from Page 34a.)

The table size is 30" x 40" with spindles 20" apart. All yokes are fitted with extra capacity ball bearings, thoroughly protected for oil, yet adequately guarded against dirt. Spindles are provided with thrust bearings, and are fitted to permit the use of chucks, router bits, or drills.

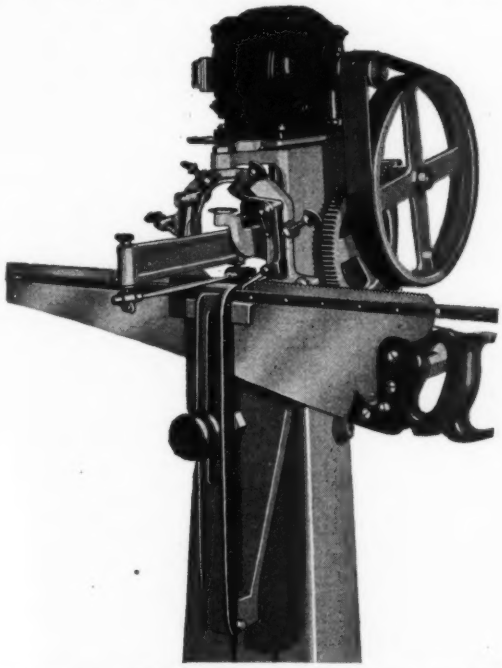


A NEW DOUBLE-SPINDLE SHAPER.

These two types give the instructor an opportunity to choose either a direct motor-drive with frequency changer, or the belt type, eliminating the cost of the frequency changer, yet getting the desired speed.

A NEW SAW FILER

The Foley Saw Tool Company, Inc., of Minneapolis, Minn., have announced a new Model 5-F power-drive, automatic saw filer mounted on pedestal. This saw filer is designed to permit the filing of all types of saws such as crosscut and rip, back, miter box and panel



NEW MODEL F-S POWER DRIVE FOLEY AUTOMATIC SAW FILER, MOUNTED ON PEDESTAL.

saws. Moreover, it files band saws up to 4½ inches wide and circular saws up to 16 inches in diameter. Another feature is that it automatically joints the saw while it is being filed. The process keeps the saws in perfect condition and eliminates all uneven teeth.

Everyday Art, January, 1927. The issue contains an article on Writing up the School-Art Exhibit, by C. W. Knouff; on Color, by Jane B. Welling; on Cumulative Records for Art Classes, by James C. Boudreau; on What We Did With Marionettes, by Marjorie D. Blatchley.

HIGGINS'
Drawing Board & Library Paste

IN new water well jars as well as in the standard plain jars.

These new, ever-ready jars, with their convenient water wells and brushes, make it possible for you to work up this paste to exactly the consistency you wish, to spread it speedily over your drawing paper before you fasten it down to the board. This entirely eliminates the older, slower and messy method of applying the paste with the hands.

Higgins' Drawing Board and Library Paste keeps the paper permanently FLAT on the board. Wet, inked areas on the paper cannot stretch, warp or wrinkle it. There's always a smooth, even working surface, without lump or blemish because of the uniform consistency and even drying qualities of the paste. It is guaranteed against warping and wrinkling, or discoloring the paper either before or after the inks are applied.

Water well jars (with brush) in 5 and 8 oz. sizes; screw-capped jars for those who prefer, in 3, 6, 14 and 32 oz. capacities.

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CHAS. M. HIGGINS & CO., MANUFACTURERS

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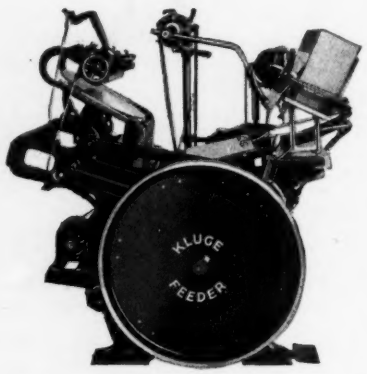

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Not only does the KLUGE feed and deliver with almost human intelligence, it will handle any kind of stock from onion-skin to 8-ply board — as well as envelopes.

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(Concluded on Page 37a.)

of cooking. Installation of equipment is completed. Forty girls between the ages of 14 and 15 years have been selected for training. They will be taught sewing, millinery, cooking, preparation of menus, and putting up food in cafeteria style. Assistant Superintendent Kramer explains that it is the intention gradually to expand the school and in the near future inject simple office-work instruction in the course.

Trade Courses Offered. The South Park Vocational School, at Beaumont, Tex., has an enrollment of fifty boys, who have elected such courses as machine-shop practice, automobile repair and drafting. The trade school is housed in a special building, which has been planned and erected for vocational purposes. Mr. W. C. Holland is head of the school.

Home-Economics Work on Vocational Plan. The home-economics work of the high school of the South Park district, Beaumont, Tex., is conducted on a vocational plan approved by the state education department. About three fourths of the girls in high school take one or more years of home-economics work. The department is housed in a special cottage located adjacent to the main buildings.

Vocational-Agriculture Work. Mr. N. A. Cleveland has established a class in vocational agriculture, emphasizing the study of poultry production.

New Courses Added. With the development of the six-three-three system at Pawtucket, R. I., the industrial-arts department has added more subjects to its curriculum. In addition to mechanical drawing and woodworking, the department now offers to the first-, second-, and third-year classes machine-shop practice, electric wiring, sheet-metal work, and printing.

The first year of the junior high-school program has been an experimental one for determining what the boys of the adolescent age can do. If the student during the tryout period, does not find a vocation which he thinks he can make a success of as a lifework, he has an opportunity to eliminate intelligently these and similar industries from future consideration. The aim is to keep the pupil's individuality intact by making the program flexible. The work, as carried on at present, will be developed and enlarged as the junior high-school system is placed in complete operation.

Adopt Apprenticeship Agreement for Plumbers. The National Trade Extension Bureau of the Plumbing and Heating Industries, at Evansville, Ind., has adopted an apprenticeship agreement for plumbers. The document contains a contract to be entered into by the apprentice and the employer, and rules governing the apprentice, the employer, the journeyman, schooling, work, and wages. The agreement is printed in triplicate in order that one copy may be given to the employer, the apprentice, and one retained by the secretary of the apprenticeship committee.

Students Print Paper for School. The print-shop students of the Boys' Technical High School, Milwaukee, print the paper for the Second Avenue School. The paper consists of sixteen pages, written by pupils of the school, and contains jokes, cartoons, news, and alumni notes.

Printers Take Cooperative Work. Four printing students of Stout Institute, Menomonie, Wis., have entered upon a semester of cooperative work at the McGill-Warner Publishing Company, St. Paul, Minn. The students will be changed frequently to different jobs in order that they may become acquainted with each phase of the work and get a good idea of the whole scheme of printing. The boys will be paid a stipulated wage while employed at the plant.

Vocational Guidance. Vocational guidance was added to the high-school course at Quanah, Texas, during the past school term.

The vocational school of Imperial, Pa., won high honors at the state farm products show held at Harrisburg. One of the trophies was a $100 scholarship.

Dairy schools are being held throughout the state of Idaho under the auspices of the state agricultural department.

A large number of farmers attended the marketing school conducted at Greeley, Colorado. R. W. Foard of Fort Collins, in charge of vocational education, and C. G. Sargent of the Colorado Agricultural College, were in attendance.

J. R. Stubbs, head of the vocational department of the Summitville, Indiana, high school and secretary of the Madison county vocational-teachers' association, recently told in a public address the state's beginning in vocational education. It began with farmers' institutes, which were created by law in 1899. He said: "Farmers' institutes have done much to inspire in the public mind a higher regard for the dignity and importance of agriculture as well as to introduce many new practices in the development of agriculture in Indiana."

There is a movement on foot in Oshkosh, Wis., to name the new vocational school the Clara Winter Everett Vocational School in honor of a pioneer instructor in the Oshkosh High School.

An annual boys' vocational congress was recently held at Bozeman, Montana, with considerable success. Practically every high school in Montana was represented. Superintendent M. C. Dietrich of Bozeman, presided.